NEW ZEALAND INSTITUTE.

NOTICE TO MEMBERS.

THE publications of the New Zealand Institute consist of—

1. Transactions, a yearly volume of scientific papers read before the local Institutes. This volume is of royal-octavo size.

2. Proceedings, containing report of the annual meeting of the Board of Governors of the New Zealand Institute, abstracts of papers dealing with New Zealand scientific matters and published elsewhere, list of members, &c. The *Proceedings* are of the same size as the *Transactions*, and are bound up with the yearly volume of *Transactions* supplied to members.

3. Bulletins. Under this title papers are issued from time to time which for some reason it is not possible to include in the yearly volume of *Transactions*. The bulletins are of the same size and style as the *Transactions*, but appear at irregular intervals, and each bulletin is complete in itself and separately paged. The bulletins are not issued free to members, but may be obtained by them at a reduction on the published price.

LIBRARY PRIVILEGES OF MEMBERS.—Upon application by any member to the Librarian of the New Zealand Institute or of any of the affiliated Societies such works as he desires to consult which are in those libraries will be forwarded to him, subject to the rules under which they are issued by the Institute or the Societies. The borrower will be required to pay for the carriage of the books. For a list of the serial publications received by the Library of the New Zealand Institute during 1924 see pp. 810-17.

ADDRESSES OF MEMBERS.—Members are requested to notify the Secretary of any change of address, so that the same may be noted in the List of Members.

MEMORANDUM FOR AUTHORS OF PAPERS.

THE attention of authors is particularly directed to the following instructions, the observance of which will greatly aid the work of both Editor and printer. It is of importance that in typewritten as well as other copy ample space should be left between the lines.

1. All papers must be typewritten, unless special permission to send in written papers has been granted by the Editor for the time being. Wide spacing between the lines and ample margin should be left.

2. The author should read over and correct the copy before sending it to the Editor of the *Transactions*.

3. A badly arranged or carelessly composed paper will be sent back to the author for amendment. It is not the duty of an editor to amend either bad arrangement or defective composition.

4. In regard to underlining of words, it is advisable, as a rule, to underline only specific and generic names, titles of books and periodicals, and foreign words.

5. In regard to specific names, the International Rules of Zoological Nomenclature and the International Rules for Botanical Nomenclature must be adhered to.

6. Titles of papers should give a clear indication of the scope of the paper, and such indefinite titles as, *e.g.*, " Additions to the New Zealand Fauna " should be avoided.

7. Papers should be as concise as possible.

8. Photographs intended for reproduction should be the best procurable prints, unmounted and sent flat.

9. *Line Drawings.*—Drawings and diagrams may be executed in line or wash. If drawn in line—*i.e.*, with pen and ink—the best results are to be obtained only from good, firm, black lines, using such an ink as Higgin's liquid India ink, or a freshly mixed Chinese ink of good quality, drawn on a smooth surface, such as Bristol board. Thin, scratchy, or faint lines must be avoided. Bold work, drawn to about twice the size (linear) of the plate, will give the best results. Tints or washes may not be used on line drawings, the object being to get the greatest contrast from a densely black line drawn on a smooth, white surface.

10. *Wash Drawings.*—If drawing in wash is preferred, the washes should be made in such water-colour as lamp-black, ivory black, or India ink. These reproduce better than neutral tints, which inclines too much to blue in its light tones. High lights are better left free from colour, although they may be stopped out with Chinese white. As in

line drawings, a fine surface should be used (the grain of most drawing-papers reproduces in the print with bad effect), and well-modelled contrasted work will give satisfactory results.

11. *Size of Drawings.*—The printed plate will not exceed 7¼in. by 4½in., and drawings for plates may be to this size, or preferably a multiple thereof, maintaining the same proportion of height to width of plate. When a number of drawings are to appear on one plate they should be neatly arranged and if numbered or lettered in soft pencil the printer will mark them permanently before reproduction. In plates of wash drawings, all the subjects comprising one plate should be grouped on the same sheet of paper or cardboard, as any joining-up shows in the print. Text-figures should be drawn for reduction to a width not exceeding 4½in. If there are a number of small text-figures they should be drawn all for the same reduction, so that they may be arranged in groups.

12. *Maps.*—A small outline map of New Zealand is obtainable at a low price from the Lands and Survey Department, Wellington, upon which details of distribution, &c., can be filled in according to the instructions given above for line drawings.

13. *Citation.*—References may be placed in a list at the end of an article or arranged as footnotes. The former method is preferable in long papers. In the list references are best arranged alphabetically, reference in the text being made by writing after the author's name, as it occurs, the year of publication of the work, adding, if necessary, a page number, and enclosing these in parentheses, thus: "Benham (1915, p. 176)." Example of forms of citation for alphabetical list:—

BENHAM, W. B., 1915. Oligochaeta from the Kermadic Islands, *Trans. N.Z. Inst.*, vol. 47, pp. 174-85.

PARK, J., 1910. *The Geology of New Zealand*, Christchurch, Whitcombe and Tombs.

When references are not in alphabetical order the initials of the author should precede the surname, and the year of publication should be placed at the end. Care should be taken to verify the details of all references—date, pages, &c.—and initials of authors should be given.

14. In accordance with a resolution of the Board of Governors, authors are warned that previous publication of a paper may militate against its acceptance for the *Transactions*.

15. In ordinary cases twenty-five copies of each paper are supplied gratis to the author, and in cases approved of by the Publication Committee fifty copies may be supplied without charge. Additional copies may be obtained at cost price.

TRANSACTIONS

AND

PROCEEDINGS

OF THE

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ERRATA.

Page 373, line 19 and 21 from foot: transpose the two lines

Opella subfimbriata

and

—— —— *kielmansegi*.

Page 457, line 13 from foot, for

Costokidderia pedica n. sp. (Figs. 96-98)

read

Costokidderia lyallensis n. sp. (Figs. 93-95).

Page 653, line 5 from foot: for gladular read glandular.

Page 663, line 4 from foot: for spermatocysts read spermatocytes.

Page 665, line 1 of par. 3: for vericulae read vesiculae.

Page 672, line 6 from foot, for

Hynsithocus . . .

read

Hypsithocus . . .

Plate 55, figs. 1 and 2: for x ½ read nat. size.

CONTENTS.

MISCELLANEOUS.

LIST OF PLATES.

PRESIDENTIAL ADDRESS.

THE following is the Presidential address delivered before the New Zealand Institute, on 28th January, 1926, by Dr. P. Marshall:—

RESEARCH IN NEW ZEALAND.

Situated as New Zealand is, with a small population, with relatively few resources, it is obvious that scientific research in general must be on a relatively small scale. So far as concerns the new problems of chemistry, physics, and other sciences which in their local features are also cosmopolitan, the small and insufficient equipment, the small number of workers, and the paucity of available funds, make it difficult to add to the progress of knowledge in any important degree.

It is natural and inevitable that in this country research should tend to be centred round the features and products of the fauna and flora, and round those industries upon which the prosperity of the country depends.

We all know that at the present time the scientific research which is at work amongst us is little organized, and advance is in the main due to the activity of individuals instead of to the coordinated effort of an organization of workers. There are amongst us some who work without any association with institutions or firms. There are others—lamentably few, I fear—who are employed by firms to study their methods and products with a view to improving them or of reducing the costs that are incurred in their manufacture.

Valuable research is carried on by the staffs of our University Colleges, but here again the smallness of our resources unfortunately makes it inevitable that the greater part of the effort put forth at these Institutions has to be devoted to teaching students, and the assistance available barely enables the Professor to complete the routine duties of his position.

Many of the Government Departments have felt the need of research work in the activities in which they are engaged on behalf of the State, and staffs are being gradually built up to grapple with problems as they arise.

In these different spheres there is a considerable total of active research-students who display energy and capacity in dealing with the problems presented to them.

Of late years the Government has given a small annual subsidy to the New Zealand Institute for payment of expenses incurred in research work the subject of which, as well as the investigations, have been approved by the Institute. In all cases the subject of study has been previously admitted by the Minister of Internal Affairs as one that justifies the expenditure of money by the State. By this action the Government has definitely recognised that the constitution of the New Zealand Institute is such that it is in a position to decide upon the subjects which are specially deserving of

research, and also to guarantee the qualifications of those who aspire to undertake the very important national work of this nature.

A report on the subjects selected and the work that has been done is presented at the annual meetings of the Board of Governors of the Institute.

It would certainly improve the prospects of successful research if the efforts of investigators in this country were more organized. At the present time it may often happen that overlapping takes place. One and the same subject of research may be attacked by two workers in different parts of the country, both of whom may labour long over preliminary observations and measurements without knowledge of one another's activities, and also without that encouragement and mutual assistance which results from comradeship—more especially in research than in other activities of life.

When the great war brought so prominently before the Government and the people the high importance of scientific work and the ultimate dependence of national existence upon the results of it, there seemed a prospect that scientific effort in this country would be effectively organized. At the request of the Government representatives of the Institute and of other scientific bodies prepared schemes for the thorough organization of scientific research. The time of national stress passed and a period of financial stress succeeded it. The attitude in regard to scientific research changed like a weather-cock. It was clearly thought that such work was a luxury, and should be most properly undertaken by those countries that were blessed with the most abundant resources and with long-established and well-endowed institutions where expert staffs possessed of wide knowledge and provided with all the equipment that money can provide would carry on investigations for the benefit of the world at large.

In a consideration of this kind one is necessarily led to estimate exactly what benefit our country is likely to reap from the scientific research which the Institute endeavours to instigate, encourage, and develop.

It is perhaps unnecessary at the present time to labour the well-established fact that scientific research, which ultimately in its economic applications may found industries and enrich nations, may in its inception appear abstract and academic. To the scientific man there are instances of this on every hand, and some of the more picturesque have been mentioned time and again at public meetings and have received prominence in the modern wonderful medium for distributing information of the most varied kind—the public press. The chemist working obscurely with test-tube and retort, and without expectation of anything but extension of knowledge, yet produced results that in the elaboration of the so-called aniline dyes has added immensely to the amenities of life. Women owe to him the resplendent colours of the slender costumes in which they enrobe themselves. He has beautified every home and added to the lustre and glory of the functions of regal courts.

What could be more of the nature of academic research than estimation of the latent heat of evaporation? What could be more of a scientific plaything than the cryophorus? Yet these researches

and playthings were definite stepping-stones in the development of methods that have ended in the establishment of the great industries which depend upon the transhipping of frozen goods from one end of the world to the other; industries that have enriched nations, have reduced the cost of living to the poorest in European countries and have enabled the crowded populations of over-peopled lands to enjoy wholesome food in abundance.

The study and classification of small and unpleasant insects is not usually regarded as scientific work likely to benefit mankind. The man who devotes himself to scientific research of this kind is regarded almost with suspicion as one who is harmless perhaps, but still rightly apart from the community at large. How many people think of him as one who may be assisting to benefit his fellows in most important respects Yet some of these men have rendered important aid in gaining the information that has so greatly reduced the fatal malaria of tropical regions. If indeed, scientific methods were fully applied this disease would now be eliminated from those localities where it had been rampant and pestilential.

These are but three instances in which patient, obscure, and prolonged research has resulted in achievements which have vastly affected the well being of mankind — millions have been saved from a lingering death whilst still in their prime. The feeding and welfare of nations have been maintained, and the happiness and joy of life have been fostered. No man of knowledge and learning can dare to say that such and such a subject of research is useless and academic and undeserving of support from the resources of the State. All must recognise that research which appears dull and unprofitable in itself may blossom forth into some discovery which will vitally affect the comfort and well-being of all. It may provide a necessary detail which will be required in the building-up of a structure on which humanity will rise to a higher level of comfort, well being, and knowledge.

While it is thus a maxim with scientific men that no distinction can be drawn between pure scientific research and economic research, it still remains true that there are certain industries and pursuits that seem to require the aid of research in order to remove some difficulty in operation or to improve the quality of the product.

It is research of this kind that is most favoured and encouraged in New Zealand. While it is obvious that direct attack of the problem is the most promising, it may often be the case that the final solution will be obtained from some other line of research which may appear remote from the problem and devoid of bearing on it.

It may not be out of place to mention some of these subjects here. The condition of our frozen produce on arrival in Europe is a matter of constant concern. Our distance from the market is greater than that of any other country which supplies it, and for this reason alone extra care must be taken to ensure that every deleterious condition is entirely eliminated. Whilst confidence is always dangerous, it can be said that satisfactory condition has now been attained though some details still demand research and are now being attacked. This is particuarly true in regard to the conditions of cooling under which apples are transported overseas. It has been

found that extremely slight differences in the attendant conditions greatly affect the final result, and some of these have been definitely ascertained, and promising research still continues with the probability of a satisfactory result.

This question suggests also that much research is still necessary in regard to the conditions under which these substances which are placed on the Home Market are produced. Our pastures are far too haphazard. We are really ignorant of the actual details of any of them. We do not know accurately what association of pasture-plants in any one district will give the most satisfactory result. We do not know to what extent the nutritive value of the different pasture-plants differs in various parts of the country. We do not know how much they vary from year to year, nor the precise effect of the various fertilizers that are now somewhat freely employed. In these questions there is a vast field open for research which may well result in immense benefit to our country.

The great problem of bush-sickness has been capably attacked, and is in a fair way of being solved. The treatment of the pumice-lands and of the poorer clay-soils of the north is now understood, but it is probable that further advances still can be made in regard to them if more research is made into their peculiarities and possibilities.

Another aspect of this matter requires much and careful research. The trees and plants in our orchards and crops have in all cases been imported, and have in nearly all instances shown that the soil and climate suit them admirably, for they have thriven exceedingly. The same phrase unfortunately applies to the insect and fungus blights to the attack of which they are subject. Often enough these blights have come from the four corners of the world, and have been imported without attendant parasites or antagonistic organisms which have kept them in check in their native land. The natural result has been a rapid and alarming spread throughout the land with attendant serious loss and almost disaster to the orchardist. Much research is required in order to develop methods to combat these pests under the special conditions in this country A good deal has been done, and within the last few years the introduction and distribution of natural enemies of some of the most widespread blights has greatly improved the position of fruit-growers. Here again continuous and careful research will benefit the country to an extent that will cause the increase of annual returns to completely eclipse the small expenditure that may be incurred in conducting them.

The one industry that is dependent upon the cultivation of an indigenous plant is that of the production of phormium fibre. At present little attempt has been made to develop a variety of the indigenous plant with an improved fibre. The export is almost entirely derived from plants that are still growing as nature planted them. It is well known that the value of the fibre is widely different in accordance with the locality where the plant has been growing. Systematic and continuous culture under careful control would be almost certain to develop a variety which would give a greater yield of fibre of finer quality than is now placed on the market.

Our timber producing industry has of late years benefited greatly from research, and though indigenous forest is still in many parts of the country being recklessly destroyed, research has shown what varieties of trees can be profitably planted in order to supply the needs of the future. Large areas of land otherwise unproductive have been planted and operations on an extensive scale are still in progress. Investigations on the growth of our indigenous trees are being undertaken by energetic workers, and it is hoped that important results will in time accrue.

There is a large area of beech forest on the mountain ranges throughout the country. The timber derived from it has not in general met with favour, and the forests are untouched. It seems that the wood is too hard for paper making. Is it not possible that research here might result in the foundation of an important industry? This seems the more promising as the beech forest is usually able to regenerate itself more readily than is the case in New Zealand with most of our indigenous forest formations. Whether the waste products of our timber-mills could be utilized has been the subject of a good deal of research, but so far without much beneficial result.

Not only have the conditions in New Zealand proved wonderfully favourable to the growth of insect blights which are more easily kept in check in other countries, but we well know that introduced plants relatively harmless in their own country have run rampant here and have overspread land in all directions and have even taken charge of large areas. The blackberry and the gorse are the most notable, and it is even said with some approach to truth that the West Coast of the South Island from the Karamea to Hokitika is one blackberry bush. The great Linnaeus, who on his knees thanked God for the glorious sight of an English gorse-bush in full blossom, would have thought himself removed to the regions of bliss had he been suddenly transported in the month of September to a gorse-covered hill in New Zealand.

So serious is the present menace that the Government has actually offered a bonus of £10,000 for any effective means of destroying these plants. Here indeed is a bonus placed on research, and it is hoped that some investigator will earn the reward which will surely be accompanied by the thanks of a grateful country.

Not insects, fungus blights, and flowering plants alone have shown surprising vitality when introduced. The rabbit has long been a curse in all areas of light soil in the less-favoured pastoral areas, and in attempts to reduce its numbers measures have been adopted that have unfortunately reduced many species of native birds to the verge of extinction. Deer also have increased beyond all expectations, and now threaten to destroy native forests over large areas. Even the increase of the opossum is viewed with misgiving by fruit-growers. Measures to reduce the rabbit-plague offer wide scope for scientific research, but the huge herds of deer can probably be kept in control by the removal of restrictions on sportsmen.

In the geological field efforts have been made since the earliest days of colonization to find deposits of valuable minerals, and these

efforts are still maintained. We know that there is a great variety of clays, and research amongst these would almost certainly reveal materials from which many types of pottery could be made. Sands suitable for glass-making are in abundance and can probably be employed with a minimum of research. It is perhaps in connection with the utilization of brown coals that work on our mineral resources has its most promising outlook. The fragile nature of these fuels when burning renders them unsuitable for use on the railways. Much work is now being done with the object of treating them in such a way as to render them of service for this purpose. Success would ensure the employment of much additional labour, and the firing of locomotives in the North Island at least would be less costly.

The great importance that modern engineering methods have given to oil-fields has stimulated investigations into the question of a possible supply of mineral oil being proved in New Zealand. Seepages of oil have long been known in several districts, but so far no success has been attained by the efforts that have been made to discover large supplies; much geological research has been conducted in the more promising districts, but much more is required before any certainty can be reached in regard to the depth and extent of the oil-bearing strata.

Another possible source of supply is to be found in the distillation of some shales and brown coals. Investigations have been in progress for some time, and are being continued with considerable prospect of success.

A special problem in New Zealand, especially in the North Island, is the construction of suitable and durable roads for the transport of produce. Methods of construction and supply of material have been somewhat haphazard in the past, but it is recognised that greater knowledge and more definite methods of construction are required. A primary requisite is research in regard to the actual value of materials that are available for road construction. This is now being carried out and it is hoped that the information that is being gained will prove of great value in the formation of roads suitable for the more intense traffic of the future.

There is one subject calling out for detailed study, though it is not likely that any financial benefit would result from it. We have in the Dominion one of the most interesting volcanic districts in the whole world;—geysers, fumaroles, hot springs in infinite variety, sulphur waters, silica waters, with temperature always varying and contents largely unknown. There is yet no accurate description of the district. The best we have was written by a foreigner in 1864, twenty years before the great eruption occurred. It is almost incredible that this wonderful district should be advertised the whole world over and yet when visitors are attracted here to see it we are not able to give them any exact information about this extraordinary area for which we are rightly famed in all countries.

A great difficulty that is now experienced in much country in the back blocks is the development of "second growth" in relatively rough land where the rainfall is considerable and the re-

sources of the owner are relatively small. Here botanical and agricultural experts and the practical farmer must co-operate in making observations. It is reasonable to think that such conjunction of effort will save much of our land from relapsing to an unproductive state.

All the large departments of the State meet with special problems in the work that they undertake for the Government of the country. They are dealt with by the departmental staffs and often require considerable research. Bridge construction, harbour works, the building of railroads, irrigation schemes, have been standardized in various countries and have been studied in their minute details, yet it is often found that New Zealand conditions differ to such an extent from those that prevail in other countries that detailed observation and structural modifications are required before methods and construction that have proved satisfactory elsewhere can be suitably adapted to the requirements of this country .

Such research that is suggested above is clearly dependent upon a desire to improve industries or activities, and are prompted by the needs or difficulties of industries already in existence. Though the aim of any particular research is there defined and the conditions are fairly evident, it is often found that in large measure all the results that are obtained have to be based upon prolonged and painstaking work that has been done in past years by enthusiasts in the study of the natural objects and the operations of nature in New Zealand.

The full description and classification of the plants, a knowledge of the insect life, of rainfall, temperature, and of the quality and arrangement of the rocks, are all and each required before many of these definite objectives can be attained. This necessary information has been gained by workers plodding along academic roads, for many years conducting research that to the layman too often seems unpractical.

The foregoing statements, which in reality hardly touch the fringe of the subject, show what a vast field for scientific investigation there is in this country. Of this much is now being attempted, and a great deal of valuable work is being done. Workers, however, are mostly isolated and out of touch with their fellow investigators—there is little or no organization, and this must lead at times to duplication, overlapping, and even to failure to reap the full result of work that has been done. While it is impossible because of geographical difficulties and various other reasons to bring the different workers into contact and to make their efforts truly cumulative and mutually supporting, it is yet certain that much may be done to make the result more effective.

To me it seems imperative that there should be some organizer or director of effort who should from his office have the power and right to inquire into the nature and amount of research at the University Colleges, Government Departments, and as far as practical into the problems encountered by various industries, which should be helped in every possible way to develop their magnitude and scope, to improve their products, and to reduce the costs.

Such a man must himself have a thorough practical knowledge of the Dominion—its productions and possessions in the mineral, vegetable and animal kingdoms—he must be possessed of attainments in chemistry and physics. Energy and insight are necessary, and a personal acquaintance as far as possible with the institutions and individuals who are capable and willing to go forward. An elastic organization, the removal of the conditions of isolation, keeping scientific men in touch with one another and informed of the progress that is being made, and of the difficulties that are being overcome, will add much to the progress of our industries, to the advancement of our knowledge, and thus to the welfare of our country.

Our research must not begin and end in the pursuit of a definite object suggested by the needs of the moment. It is not in this way that the great advances of the present time have been achieved. Watt in his early construction of a steam engine did not have the vision of the intricacies of the mechanical world of to-day. The early and academic experiments which showed that a coil of wire became magnetic when an electric current passed through it, did not suggest the generation of energy which would distribute light, heat, and mechanical power over continents. The classification of mosquitos was not completed with any idea that it would be utilized in connection with the reduction of the great scourge of malaria in tropical countries. Marconi in his early experiments of transmission of electric waves could not have visualized the wonderful development of wireless and the great saving of human life that it would effect.

It is too late in the world's history to say that this or that research is impractical and not of any service to mankind. It is out of date to attempt to divide investigation into pure scientific research and economic research. Every fact that is added to the wealth of human knowledge has its value. It may rise from obscurity to national importance in the twinkling of an eye, and from a matter of detail to a fact of the greatest value.

The practical man welcomes the acquisition of facts of all and every kind, confident in the knowledge that each will in its time and place fit in the scheme of advance that will lead to the comfort of mankind and the development of industry and the well-being of nations.

TRANSACTIONS.

TRANSACTIONS

OF THE

NEW ZEALAND INSTITUTE.

The Present Taxonomic Status of the New Zealand Species of Hebe.

By L. Cockayne, Ph.D., F.R.S. and H. H. Allan, D.Sc., F.L.S.

[*Read before the Philosophical Institute of Canterbury, 2nd December, 1925; received by Editor, 31st December, 1925; issued separately, 9th October, 1926.*]

1. Introductory.

The progress of plant-ecology in New Zealand of recent years has revealed clearly the weakness of much of the taxonomic work of the past. Ecological research has necessitated a far more intensive and better-directed study of the individual plants as they grow naturally than has hitherto been adopted. The time has thus arrived when systematic botany must avail itself of the fairly definite methods developed in field studies of the living plants, coupled, as far as may be, with experiment, and abandon the almost exclusively indoor speculations of the herbarium.

Nowhere can this need be better established than in *Hebe*, and the appearance of a new edition of Cheeseman's *Manual of the New Zealand Flora* seems to provide a fitting occasion for the examination of that supra-polymorphic genus in the light of the knowledge already gained in the field and garden, and for a statement of the methods we propose for adoption in future work. The standpoint on which our remarks are based is that detailed by the senior author in certain of his publications (Cockayne, L., 1917, 1918, and 1923), and followed in his papers, "Notes on New Zealand Floristic Botany" (1916, 1917, 1918, and 1925), for the most recent of which the authors of this paper are jointly responsible. Some further explanation, however, seems desirable.

The "herbarium" or "artificial" method of classifying *Hebe* has proved definitely inadequate. This is clear from Cheeseman's words (1925, p. 777): "The arrangement and limitation of the species, and the preparation of the necessary diagnoses, has proved to be a most difficult and perplexing task, and I am far from satisfied with the result." Notwithstanding this rather pessimistic utterance Cheeseman's painstaking work has laid a foundation for future advances, and has done all that the herbarium method was capable of, considering the limited material, and insufficiency of field-notes at his disposal.

We are, however, firmly convinced that *Hebe* and other polymorphic genera are separable into definite easily-recognizable groups by the "natural" method of field-taxonomy we here outline. It

should also be equally possible to put the intermediate forms into definite groups. As a result a close approximation should be made to achieving *the true function of a flora—the recognition of all wild plants and their status.*

As is well known the term "species," as used at present in floras, includes several concepts not clearly differentiated, and the placing of a particular form into any one species often becomes very much a matter of taste. As our fundamental field-unit we here take, with Lotsy (1916, p. 27), the *jordanon,* which may be defined as "a group of externally alike individuals which breed true when bred among themselves." A jordanon that is not closely related to any other jordanon is easily recognizable in the field as an "invariable species," and such we term a "simple species," *e.g. Hebe cupressoides.* More often groups of closely-related jordanons are met with, and such groups we term "compound species," as the more familiar terms "aggregate species" and "collective species" have now a wider and vaguer connotation. Jordanons that are sufficiently distinct to allow of effective diagnosis we call "varieties." It should be emphasized that as so defined the variety is of as much importance as the species. Compound species to which in the past taxonomy has attached "intermediates" we term "linneons." Lotsy (*loc. cit.,* p. 27) uses the term linneon "to replace the species in the Linnean sense, and to designate a group of individuals which resemble one another more than they do any other individuals." As modified by us the term linneon is used to include not only groups of allied jordanons but of the hybrids between them as well. In its widest sense it includes two or more closely related species, their jordanons, and hybrids of all categories. This is what in practice the so-called "Linnean species" have become, coupled, not seldom, with what we later define as "epharmones." The intermediates we consider to be "hybrids." Unfixed forms, due to habitat conditions, which change when these are sufficiently modified we call "epharmones." Of course, strictly speaking, the "normal form" is as much an epharmone as any other, and sometimes it would be difficult to say which form should be classed as the "normal" one, but in practice this seldom occasions any difficulty.

Hebe salicifolia, as diagnosed in the *Manual* ed. 2 (p. 790), is a linneon in which the work of the senior author—followed by Cheeseman—has gone a good way towards separating the varieties of the naturally compound species from the hybrids and epharmones. We use the term "form" where it is convenient to waive the exact status of an individual or group, or where that is unknown. With Bailey (1924, p. 25) we use the term "cultigen" for a form of unknown origin found only in cultivation.

In brief, the work of taxonomy is to resolve the linneon into its components, and plainly by the herbarium method it is impossible to surely decide whether individual plants are simple species, jordanons of a compound species, hybrids, or epharmones. At best it can but make shrewd guesses. In the field, on the contrary, many individuals of a population can be examined, and it can be seen how far they fall into natural groups, whether such occur unchanged in various localities, whether they apparently reproduce their like, and

whether a diverse progeny appears when different jordanons, varieties, or simple species occur in close proximity. Intelligent choice can be made of individuals likely to provide further light by experimental cultures.

The most difficult field-work is the recognition of the actual jordanons. This demands the co-operation of many students; herbarium and living material will be of the greatest service, not collected at random, but critically selected, labelled with the habitat and locality, one piece alone being taken from any one individual. These specimens should be accompanied by notes stating what known species of *Hebe* are present. Indeed excellent material can be obtained by a collector who cannot put "a name" to any of his specimens provided he accompanies his collecting with intelligent notes on the lines here indicated, stating *e.g.* which of his specimens are of forms pretty constant in the area. Such material should replace those worthless scraps so frequently sent by collectors for identification. Still worse are specimens from cultigens. Unfortunately the last-named abound in gardens, and many have received garden names—so easy to give, so difficult to get rid of. Few proceedings are a greater hindrance to accurate taxonomic progress than this indiscriminate naming of garden plants. Almost any form of *Hebe* is easily raised from cuttings, so that a hybrid of unknown origin again and again masquerades in gardens as a good species, and simulates such, since all the individuals almost exactly match one another.

During the whole period of our field studies, but for the last few years to a more intensive degree, we have devoted a considerable time to studying *Hebe* as it grows wild. The results so far reached prove that there are many true-breeding races or jordanons; that where hybridization is possible hybrid populations, sometimes of extreme diversity, occur; and that from such plant after plant could be selected which, if sent to a taxonomist working on the herbarium method, would be described as species of particular distinctness, or, if cultivated in gardens, would appear absolutely constant. As shown in the next part of this paper we have also been able to find distinct varieties of common species, previously unrecognized, by means of the natural method. Finally, in some cases, we have seen polymorphy in process of being extended in certain compound species, but without experimental breeding methods the new forms arising cannot be placed in any system of classification.

2. LIST OF THE SPECIES OF *HEBE*, TOGETHER WITH CRITICAL REMARKS.

In what follows a species usually is transferred to *Hebe* only when, on the strength of field observations, we are pretty well convinced it is valid. So-called "species" based on insufficient or faulty evidence we cite as *Veronica*, though of course they do not belong to that genus but to *Hebe*. Groups of hybrids are accorded names made up of a combination of the specific names of the parents in an abbreviated form with a suitable ending, *e.g.* all forms of *Hebe elliptica* × *salicifolia* belong to × *Hebe ellipsala* Ckn. et Allan. Where a hybrid has ranked as a species that occupies a position mid-

way between the parents the specific name is retained, with the accepted × sign of hybridity, *e.g.* × *Hebe amabilis* (Cheesm.*) Ckn. et Allan as hyb., which stands midway in the × *H. ellipsala* series. We go into this method of nomenclature more fully in section 3 of this paper.

Where a species has been described by the original author from herbarium material only, and he had never seen it wild, an asterisk precedes the name. It is remarkable how many species are of this unsatisfactory character.

1. ***Hebe speciosa** (R. Cunn. ex A. Cunn.) Ckn. et Allan comb. nov. = *Veronica speciosa* R. Cunn. ex A. Cunn. in *Bot. Mag.* (1836) Sub. t. 3461.

Although a compound species any form is recognized with ease, and the jordanons are evidently few in number. Many artificial hybrids with *H. speciosa* as one of the parents are in cultivation, but none have been found wild.

(*a.*) var. *brevifolia* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica speciosa* R. Cunn. var. *brevifolia* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 500.

This is the form which grows wild at the North Cape and with which Cheeseman was personally acquainted. In the account of his visit to that locality (1897, pp. 363, 374) he dealt with it as the type, but—and this is very suggestive—he calls attention to the effect of shade or full exposure on its growth-form, so it is not unlikely that the variety may be merely an epharmone.

[**Veronica carnea* J. B. Armstg. as var. hort. in *Trans. N.Z. Inst.* 13 (1881) 351.]

This is evidently an artificial hybrid cultigen with *Hebe speciosa* as one of the parents. It is widely cultivated and ranks in gardens along with the true species of *Hebe.*

2. ***Hebe Dieffenbachii** (Benth.) Ckn. et Allan comb. nov. = *Veronica Dieffenbachii* Benth. in *D.C. Prodr.* 10 (1846) 459.

Hooker remarks (1864, p. 207) "I have seen but one specimen," so probably this was the case with Bentham. Cheeseman evidently based his description of the species on the well-known, extremely common cultigen which, however, is evidently descended vegetatively from one individual which itself may be of garden origin. At any-rate, L. Cockayne saw nothing to nearly match it in Chatham Island and Cheeseman calls attention to the "considerable range of variation" in Cockayne's specimens. Evidently, the species is compound, but of its jordanons nothing is known. Forms of more erect habit are cultivated in gardens.

3. **Hebe Dorrien-Smithii** (Ckn.) Ckn. et Allan comb. nov. = *Veronica Dorrien-Smithii* Ckn. in *Trans. N.Z. Inst.* 44 (1912) 51 of Proceedings.

*Cheeseman of course is responsible only for the specific name and not for the nature of the group, for to him the latter was a true species; in fact we are not at all sure that his name should be cited—the differences between the two conceptions of the group being so wide.

The original description, drawn up from living material in Cockayne's former New Brighton garden, though a "type specimen" is referred to, frankly treats the species as compound. There is great diversity amongst the individuals and every sign of the crossing of distinct jordanons. Really the species is a linneon and fresh observations are demanded before an analysis can be made separating it into its constituent jordanons or even species and their hybrids. For instance, the " type," No. 8005, Herb. L. Cockayne, may quite well be a hybrid that may never be seen wild again, and if so the name would be invalid!

[***Veronica Barkeri** Ckn. in *Trans. N.Z. Inst.* 31 (1899) 421.]

We are not changing the name to *Hebe* since the description was drawn up from an individual cultigen of unknown origin. The shrub is very common in gardens and is recognizable at a glance, all individuals having been produced vegetatively. We unhesitatingly remove it from the New Zealand flora.

4. **Hebe Adamsii** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica Adamsii* Cheesem. in *Man. N.Z. Flora ed.* 2 (1925) 786.

We know nothing of this. It is not mentioned by Cheeseman in his account of his journey to the extreme north of the North Island (Cheeseman, 1897), during which he must have collected his specimens, nor is it dealt with in the first edition of the *Manual.* From the description it appears to be a distinct plant, and as its author speaks of it as " not uncommon " and says nothing regarding " variation " the species is possibly valid.

5. **Hebe Bollonsii** (Ckn.) Ckn. et Allan comb. nov. = *Veronica Bollonsii* Ckn. in *Trans. N.Z. Inst.* 44 (1912) 50 in Proceedings.

Apparently a distinct simple species. No polymorphy was noted by its author, nor do specimens recently collected by W. R. B. Oliver show non-uniformity, except such as is environmental. Cheeseman states he found it abundant on the Hen and Chickens Islands in 1880, but he neglected to mention it in the first edition of the *Manual.*

6. **Hebe obtusata** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica obtusata* Cheesem. in *Trans. N.Z. Inst.* 48 (1916) 213.

We have seen only a few plants of this species in its habitat, so can say nothing of its status. Petrie has described a hybrid between this and *Hebe salicifolia* under the name × *Veronica Bishopiana* (*Trans. N.Z. Inst.* 56 (1926) 15), but apparently from only one individual, since his description might well apply to an "invariable" species, and there is only the one specimen in his herbarium.

7. ***Hebe macroura** (Hook. f. ex Benth.) Ckn. et Allan comb. nov. = *Veronica macroura* Hook. f. ex Benth. in *D.C. Prodr.* 10 (1846) 459.

As defined by Bentham this was a simple species, but in the *Handbook* Hooker enlarged its conception so as to include specimens collected by Colenso (but not "on the authority" of that collector as stated

in the *Manual* ed. 2., p. 788) near Whangarei and Cook Strait. In the *Manual* ed. 1, Cheeseman still further extended the conception of the species, adding *V. Cookiana* Col. and a var. *dubia* (now *Hebe obtusata*). In 1919 L. Cockayne restricted the species to the coastal plant, or plants, of the East Cape Botanical District, and this procedure was later followed by Cheeseman in the *Manual* ed. 2. As thus restricted, judging from field observations, the species still appears to be compound, but its jordanons will not be easy to distinguish, since they appear to cross readily with the variety of *Hebe salicifolia* which so frequently grows in their company.

8. ***Hebe Cookiana** (Col.) Ckn. et Allan comb. nov. = *Veronica Cookiana* Col. in *Trans. N.Z. Inst.* 20 (1888) 201.

This has apparently only been collected by H. Hill. We know it only as a garden plant of most distinct appearance since it is descended vegetatively from one individual. We admit the species with hesitation. From the Sugar-loaf rock near New Plymouth we collected abundance of a *Hebe*, closely related to *H. Cookiana,* but hesitate to deal with it for the present. In Petrie's herbarium (now under the charge of Mr. W. R. B. Oliver and housed in the Dominion Farmers' Institute, Wellington) this is referred to *H. macroura*.

[***Veronica divergens** Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 502.]

This is most likely a hybrid. H. J. Matthews informed us that he saw it growing alongside *H. elliptica* where Townson first collected it—so far its sole locality. Probably *H. salicifolia* would also be present. In Petrie's herbarium it is represented by a number of distinct forms having racemes of the " salicifolia " type but differing in length and with the flowers closer together. Some have leaves of the " elliptica " type and others those of *H. salicifolia,* but much shorter. There is a form in cultivation which clearly suggests a hybrid origin.

9. ***Hebe ligustrifolia** (A. Cunn.) Ckn. et Allan comb. nov. = *Veronica ligustrifolia* A. Cunn. in *Bot. Mag.* (1836) sub. t. 3461.

Up to the publication of the *Manual* ed. 1, all New Zealand botanists, including Cheeseman himself (1882, p. 317), had accepted *H. ligustrifolia* in the broad sense defined by Hooker in the *Handbook of the New Zealand Flora* which included not only the species under consideration but what is now *H. leiophylla* and various narrow-leaved hybrids with *H. salicifolia* as one of the parents. As for *H. ligustrifolia* in the restricted sense we can make no definite statement, for we have seen only one wild plant which could have been referred to it. Cheeseman's personal knowledge was not much greater, since he collected it in only two localities, nor did he know at the time of collecting that it was that species (1897, p. 374, where this species is not mentioned). In fact, it was not until these specimens were examined by N. E. Brown of Kew and compared with Cunningham's " type " that he restricted the species to that defined by A. Cunningham. Cheeseman also speaks of " intermediates " between *H. ligus-*

trifolia and *H. salicifolia,* but no localities for these really interesting plants are given. Evidently critical field observations are demanded before the species can be accepted without doubt; also, what is Cunningham's type?

10. ***Hebe pubescens** (Banks et Sol. ex Benth.) Ckn. et Allan comb. nov. = *Veronica pubescens* Banks et Sol. ex Benth. in *D. C. Prodr.* 10 (1846) 460.

Judging from certain specimens collected at Mercury Bay—the original locality for the species—by Mr. C. E. Christensen, and from notes that excellent observer took relating to many plants he examined *in situ,* it is clear that there is a mixture of plants differing considerably in hairiness—the most important characteristic—and even in the colour of the hairs. It seems probable that there is a definite simple or perhaps compound species and hybrids between this and the local form of *Hebe salicifolia.* We have succeeded in "rooting" cuttings from the different forms Mr. Christensen so kindly sent us, and hope in due course to sow seed taken from each plant.

11. **Hebe breviracemosa** (W. R. B. Oliver) Ckn. et Allan comb. nov. = *Veronica breviracemosa* W. R. B. Oliver in *Trans. N.Z. Inst.* 42 (1910) 170.

This was originally referred by Cheeseman to *H. salicifolia* (1888, p. 171), but in the *Manual,* ed. 1, he suggested it might be a distinct species. Oliver (1910, p. 70) says nothing about "variation," so it is probable that it is a simple species. Further, there is no other *Hebe* on the Kermadecs with which it could cross.

12. **Hebe salicifolia** (Forst. f.) Pennell in *Rhodora* 23 (1921) 39.

This is a very large linneon with many jordanons between which there are numerous hybrids. In nature certain of the jordanons cross readily with the following, and probably other species: *H. angustifolia, elliptica, laevis, leiophylla, macrocarpa, macroura, parviflora, pimeleoides* var. *rupestris, pubescens* and *subalpina.*

(*a.*) var. *communis* (Ckn.) Ckn. et Allan comb. nov. = *Veronica salicifolia* Forst. f. var. *communis* Ckn. in *Trans. N.Z. Inst.* 47 (1916) 201.

Cheeseman gives this as a synonym of the type but according to our system of nomenclature in a compound species each variety, including the type, should have a name, so *Hebe salicifolia* should *never* be cited, unless there is no varietal name for the particular form, as it does not exist in nature but is an abstraction only; citation must include the appropriate varietal name if there is one.

(*b.*) *var. *stricta* (Hook. f.) Ckn. et Allan comb. nov. =*Veronica salicifolia* Forst. f. var. *stricta* (Banks et Sol. ex Benth.) Hook. f. in *Fl. Nov-Zel.* 1 (1853) 191.

We adhere to this variety with considerable hesitation, for it is certainly a mixture of jordanons. How uncertain Cheeseman must have been in regard to it is clearly shown by the fact that in the *Manual* ed. 1, he spoke of it as "abundant throughout," *i.e.* North and South and Stewart Islands, but in edition 2, basing his opinion

on virtually the same material, he restricts var. *stricta* to Auckland, Northern Wellington, Hawkes Bay and Taranaki, while he follows L. Cockayne in referring his South Island material to var. *communis*. The real " var. *stricta* " is the original plant collected by Banks and Solander, which, according to their plate, represents a form with a rather open raceme. Our var. *stricta* is based on a much wider conception and includes many forms—possibly distinct jordanons—of the Auckland botanical districts which do not match any of the other recognized varieties.

(*c.*) var. *longiracemosa* (Ckn.) Ckn. et Allan comb. nov. = *Veronica salicifolia* Forst. f. var. *longiracemosa* Ckn. in *Trans. N.Z. Inst.* 49 (1917) 61.

This occurs without evident polymorphy throughout the southern part of the Egmont-Wanganui Botanical District. Cheeseman (1925, p. 791) records it also from the Volcanic Plateau, East Cape and South Auckland districts, but whether all the plants so included match the type we do not know, though some in Petrie's herbarium appear to do so.

(*d.*) var. *paludosa* (Ckn.) Ckn. et Allan comb. nov. = *Veronica salicifolia* Forst. f. var. *paludosa* Ckn. in *Trans. N.Z. Inst.* 48 (1916) 201.

This distinct jordanon, more distinct indeed than many accepted species, confined to the western part of the Western Botanical District forms a striking series of polymorphic hybrids with var. *communis*, so that from herbarium material it could never have been made a variety, except by guess-work, or had there been only specimens of the type, all taken from one plant, it would doubtless have figured as a distinct species. Cheeseman includes the variety of the Mount Egmont subalpine-scrub in var. *paludosa*, but we can express no rational opinion till we have compared living material of both side by side.

(*e.*) var. *Atkinsonii* (Ckn.) Ckn. et Allan comb. nov. = *Veronica salicifolia* Forst. f. var. *Atkinsonii* Ckn. in *Trans. N.Z. Inst.* 48 (1916) 200.

This is the common, perhaps the sole variety of southern Wellington and the Marlborough Sounds. It is, however, a compound variety made up of several jordanons which hybridize, but the group is clearly marked off from any other variety of *H. salicifolia* by its juvenile form with deeply toothed leaves and its strong tolerance of rock as a habitat. Its affinity is perhaps more with *Hebe macroura* and were it not likely that it may be Forster's type of *H. salicifolia* we would unhesitatingly accord it specific rank. Before L. Cockayne discovered the plant under discussion in abundance on the shores of the Marlborough Sounds he had considered it a valid species and given it the M.S. name of *Veronica Atkinsonii*.

[var. *Kirkii* (J. B. Armstg.) Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 504.]

Cheeseman cites *Trans. N.Z. Inst.* 13 (1881) 356 as the place of publication by Armstrong, but the description there is merely a copy

with additions of the original description in the *New Zealand Country Journal* 3 (1879) 58. Cheeseman saw Armstrong's type; he also cites a specimen from H. H. Allan as *V. Kirkii,* but that is certainly var. *communis* × *Hebe leiophylla,* apparently a common enough hybrid in the North-eastern and Eastern Botanical Districts. *Veronica Kirkii* J. B. Armst. (*loc. cit.*) thus becomes × *Hebe Kirkii* (J. B. Armstg.) Ckn. et Allan as hybrid which, as seen further on, is one of the group × *Hebe leiosala* Ckn. et Allan.

(*f.*) var. *angustissima* (Ckn.) Ckn. et Allan comb. nov. = *Veronica salicifolia* Forst. f. var. *angustissima* Ckn. in *Trans. N.Z. Inst.* 50 (1918) 184.

This is omitted in the *Manual* ed. 2. Since becoming fully aware of the enormous number of *Hebe* hybrids we had felt sure that the variety was *H. parviflora* × *salicifolia.* In order to see if such were the case the junior author made a critical examination of the *Hebes* in the Otaki Gorge, where var. *angustissima* was originally collected and found—to his surprise—that it was quite constant, that there was another jordanon with rather broader leaves and that *Hebe parviflora* was absent. We therefore uphold the variety, but extend its content by adding the broader-leaved jordanon and making the taxonomic variety a compound one. The description needs no emendation, the term "lineari-lanceolatis" being still true for the form of the leaves.

13. **Hebe gigantea** (Ckn.) Ckn. et Allan comb. nov. = *Veronica gigantea* Ckn. in *Trans. N.Z. Inst.* 34 (1902) 319.

In the *Manual* ed. 1, this was considered a variety of *Hebe salicifolia.* It is apparently a simple species, no polymorphy having been observed amongst the wild plants, but certainly no one has carefully studied them. It differs from all other species of *Hebe* in being a true forest tree; and from all the varieties of *H. salicifolia* in its long-persisting, pubescent juvenile form (not merely the juvenile leaves as stated by Cheeseman) with the earlier leaves coarsely and deeply toothed and the stem usually purple in colour.

[**Veronica Parkinsoniana** Col. in *Trans. N.Z. Inst.* 21 (1889) 97.]

This is probably the ordinary form of *Hebe salicifolia* found in the neighbourhood of Dannevirke. Cheeseman, however, gives it in the *Manual* ed. 2 as a synonym of the type, which is *Hebe salicifolia* var. *communis*, but which we are not at all sure occurs in North Island.

[**Veronica rotundata** T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 530.]

L. Cockayne (1917, p. 61) brought forth strong evidence that this is a garden hybrid, the original specimen coming from what is now Newtown Park, while the plant is common in gardens. Although Cheeseman supported Cockayne's view the "species" is still maintained in the *Manual* ed. 2. It should undoubtedly be removed from the flora.

14. ***Hebe macrocarpa** (Vahl) Ckn. et Allan comb. nov. = *Veronica macrocarpa* Vahl in *Sym. Bot.* 3 (1794) 4.

This, as defined by Cheeseman, is a linneon, the analysis of which needs extended study in the field. Cheeseman speaks of a " typical state," but we think he means by this the commonest wild form and not the plant or plants on which Vahl founded his species. The group is at once recognized by the large flowers and capsules of its members.

(*a.*) var. *latisepala* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica macrocarpa* Vahl var. *latisepala* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 505.

We have always followed T. Kirk in treating this as a species, but are not too sure of our ground, which should be tested by breeding experiments.

[var. *affinis* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 505.]

Cheeseman does not supply the essential information as to the associated plants where this occurs, but only the locality—" Headlands in the Waitemata and Manakau Harbours and the adjacent coasts." He remarks of it, " apparently a passage-form into *V. salicifolia* and " might be referred to either species." He states it to be one of the " many intermediates " between *H. salicifolia* and the " typical state " of *H. macrocarpa*. Evidently these two species cross and var. *affinis* occupies a midway position between the two, as may be clearly seen in Petrie's herbarium. For the group of hybrids we propose the name × *Hebe macrosala*, and for var. *affinis* as defined by Cheeseman in *Man. N.Z. Flora* ed. 1 (1906) 505, × *Hebe affinis* (Cheesem.) Ckn. et Allan as hybrid.

[***Veronica myrtifolia** Banks et Sol. ex Benth. in *D. C. Prodr.* 10 (1846) 460.]

This is referred to in neither edition of the *Manual*. By Hooker in the *Flora Novae-Zelandiae* p. 192, it was treated as var. *β myrtifolia* of *V. macrocarpa* and defined as differing from that species in its glabrate racemes and smaller capsules. In the *Handbook* p. 207, Hooker simply places *V. myrtifolia* as a synonym of *V. macrocarpa*. The admirable plate in the Banksian drawings, designed to illustrate the plants collected by Banks and Solander, clearly shows that the species is one of the forms which comprise *H. macrocarpa*.

15. ***Hebe Townsoni** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica Townsoni* Cheesem. in *Trans. N.Z. Inst.* 45 (1913) 95.

Apparently a distinct simple species distinguished from all other forms of *Hebe* by the two rows of domatia on the back of the leaf contiguous to the margin.

[***Veronica amabilis** Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 506.]

When *Hebe elliptica* and *H. salicifolia* var. *communis* grow in proximity there arises a polymorphic series of hybrids usually included in which, in our opinion is the group placed by Cheeseman under the name *V. amabilis*. Messrs. G. Simpson and J. Scott

Thomson, working together, collected a considerable number of forms of the hybrids at Blanket Bay, near Port Chalmers, the individuals from which these were taken they labelled with copper discs, and from them cuttings similarly numbered they sent to us and others. Thus, thanks to their botanical zeal, *material for the first proper study of New Zealand wild hybrids is available.*

For the whole series of *Hebe elliptica* × *salicifolia* we propose the name × *Hebe ellipsala* Ckn. et Allan. The series includes × *Hebe amabilis* (Cheesem.) Ckn. et Allan hyb. comb. nov., × *H. divergens* (most likely), × *H. blanda* (Pennell) Ckn. et Allan as hyb., and, if truly a wild plant, × *H. Lewisii.*

[*var. *blanda* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 506.]

Pennell (1921, p. 39, working with herbarium material, erected a species *Hebe blanda* (Cheesem.) Pennell for Cheeseman's var. *blanda* of *Veronica amabilis.*

This is a matter of more than passing interest. The species, as understood by Pennell, includes (1) a specimen collected by Petrie at Port Chalmers (ex herb. L. Cockayne), (2) another collected at Anita Bay (entrance to Milford Sound) by L. Cockayne, and (3) a specimen from southern Patagonia. Now *Hebe elliptica* also occurs in southern Patagonia and *H. Fonkii* Phil. is clearly one of the jordanons of *H. salicifolia* according to Pennell, who compared an isotype collected by Fonk himself with a typical example of *H. salicifolia* var. *communis* from the herbarium of L. Cockayne, so that the same hybrid has originated *naturally* both in New Zealand and subantarctic South America! In order to obtain further evidence on this highly-important point L. Cockayne wrote to Dr. Skottsberg for South American specimens of *H. elliptica* and *H. Fonkii,* and for information concerning their ecological distribution and the possibility of their hybridizing. Dr. Skottsberg, to whom our most sincere thanks are due, sent the desired specimens and information by return of post.

The specimen of *Hebe elliptica* from west Patagonia so sent to us by Skottsberg, were its source unknown, would be considered to have been collected in New Zealand. The specimen labelled *Veronica Fonkii* seems to us to fit into the conception of × *Hebe blanda;* it certainly does not belong to the *H. salicifolia* group; that is to say it is to us identical with the specimen which Pennell considered matched what we now call × *Hebe blanda* of New Zealand. Skottsberg writes as follows: " First let us turn to the West Patagonian *Veronica.* It is identical with what Reiche, Dusen, a. o. call *Veronica salicifolia* and it is Phillippi's *V. Fonkii.* I have never heard of anyone finding more than one species of this type in South America. *V. Fonkii* may occur in company with *V. elliptica* which comes from the same kind of habitat; I think it has never been found except *on the shore.*" Were it not for the fact that in the herbarium of the New York botanical gardens there are the specimens of two quite different plants, we should have been inclined to throw the hybrid theory aside, so far as the South American plant went, and to conclude a true-breeding South American species was outwardly the double of a New Zealand hybrid. But we cannot help thinking that the South

American botanists Skottsberg mentions would deal with species as "variable" and unite as one forms fairly distinct from one another. To think otherwise would indicate that the essence of this piece of work we are now putting together was already accepted by the majority of taxonomists and that "variation," as an explanation of "intermediate forms," had gone to the wall!

The type of *V. amabilis* Cheesem. is *V. salicifolia* Forst. f. var. *gracilis* T. Kirk in *The Forest Flora of New Zealand* (1889) 244, t. 120. The plate and description clearly reveal the hybrid character of the plant, which has leaves of the *salicifolia* type but broader, inflorescences of *salicifolia* size but with the flowers far nearer to those of *elliptica* in size and shape. Cheeseman's var. *blanda* is similar but with still broader leaves which are also shorter; it has been recorded by New Zealand collectors from the Fiord and Stewart districts and by Pennell from the South Otago district, where it is probably common.

Regarding the polymorphy of × *H. blanda*—not known to Cheeseman—the following extract we have unearthed from L. Cockayne's notebook of October, 1902, is of interest: "*Veronicas*—There are three species of *Veronica* on the shore of Anita Bay. *Veronica elliptica* is the most abundant, *and is an extremely variable plant.* Collected a number of cuttings for purposes of growth. *Veronica salicifolia* of usual type is abundant and there is another *Veronica* intermediate in leaf-form between *V. salicifolia* and *V. elliptica*, similar indeed so far as I can judge to the *V. Henryi* [*nomen nudum* given by L.C. when at Dusky Sound] of Dusky Sound. *This latter also varies considerably.*"

[**Veronica Lewisii** J. B. Armstg. in *Trans. N.Z. Inst.* 13 (1881) 357.]

This is stated by Armstrong to have been found on "Downs near the sea in the south of Canterbury," but the name of the collector is not given, and most probably it was either a cultigen (Lewis was a nurseryman) or came from a different locality than that cited. Armstrong says of it, "exactly intermediate in character between *V. elliptica* and *V. speciosa* . . . . those authors who favour the hybridism theory [Armstrong explained strongly that he did not favour it, nor do we know there was any such theory at that date] as accounting for the variations of species would probably class this as a hybrid, but such an idea is exceedingly improbable in this case, as no plants of *V. speciosa* have been found within 200 miles of the district where this plant was found, although the whole district has been very carefully botanized [A bold statement if made even now]. Besides hybrids usually show very great variation in the characters of their flowers, but this plant is one of the most constant species in the colony." The last statement is certainly true enough for the plant in gardens, as *all* are vegetatively derived from a single original. We consider its hybrid origin certain, and that it has nothing to do with *Hebe speciosa.*

16. ***Hebe chathamica** (Buch.) Ckn. et Allan comb. nov. = *Veronica chathamica* Buchanan in *Trans. N.Z. Inst.* 7 (1875) 338, t. 13, f. 1.

As growing wild on the coastal rocks of Chatham Island this is an exceedingly polymorphic linneon, which requires close study and analysis in the field. By such methods only can the status of var. *Coxiana* (T. Kirk) Cheesem. be determined, but at present we cannot uphold it as a variety. There are several distinct forms in cultivation, but fortunately none have received as yet more than *nomina nuda*.

[***Veronica acutiflora** Benth. in *D. C. Prodr.* 10 (1846) 460.]

All the specimens referred to this in the *Manual* came from Kerikeri Falls (Bay of Islands), and of them Cheeseman states, "This appears to be a variable plant. Mr. Colenso's specimens have the pedicels and calyces nearly glabrate; in Kirk's and Petrie's they are softly pubescent. So far as is known the species is restricted to a single habitat, where it was originally discovered by Allan Cunningham." Specimens sent to us by Petrie show considerable diversity. We consider it to be a hybrid, probably between *Hebe salicifolia* var. *stricta* and *H. ligustrifolia*, and do not admit it to the flora as a good species.

17. ***Hebe angustifolia** (A. Rich.) Ckn. et Allan comb. nov. = *Veronica angustifolia* A. Rich. in *Fl. Nouv. Zél.* (1832) 187.

We have some evidence that this is a compound species, but the jordanons are probably so close that at present we do not give to any varietal names, but possibly *Veronica squalida* T. Kirk is a jordanon. *Hebe angustifolia* crosses freely with any form of *H. salicifolia* which may be present and for this extensive group we propose, further on, the name × *Hebe angustisala*. One member of the group has already been deliberately described as × *Veronica Simmonsii* Ckn. in *Trans. N.Z. Inst.* 48 (1916) 202, but it is not mentioned in the *Manual* ed. 2. It, however, consists of a small group of plants which do not differ greatly from one another and one of the parents was *H. salicifolia* var. *Atkinsonii* whereas the larger part of × *H. angustisala* results from a var. *communis* cross.

[*var. *abbreviata* Petrie in *Trans. N.Z. Inst.* 53 (1921) 371.]

This was apparently described from specimens taken from one individual and from the brief description seems to be *H. angustifolia* or *H. leiophylla* × *H. montana* or *H. Traversii*. It is accepted as a valid var. by Cheeseman.

18. ***Hebe parviflora** (Vahl) Ckn. et Allan comb. nov. = *Veronica parviflora* Vahl in *Sym. Bot.* 3 (1794) 4.

Whether this is really Vahl's species we do not know. As defined by Cheeseman it represents a well-defined simple or perhaps compound species considering its wide range. It is in part equivalent to *Veronica arborea* Buch., this at anyrate a jordanon.

19. **Hebe leiophylla** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica leiophylla* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 510.

Before the publication of the Manual this was referred sometimes to *Hebe ligustrifolia* and sometimes to *H. Traversii*. It is a well-

marked compound species, with its jordanons very similar to one another, which occurs in the Sounds-Nelson District, the junction of this district with the North-western District, the North-eastern District, the Eastern District—in the two last districts extremely abundant—and, judging from certain specimens in Petrie's herbarium, "the eastern part of Otago," wherever that may be, but evidently rare. Cheeseman gives Nelson to Otago as its distribution, but it is absent in the North-western (except as stated above), the Western, the Fiord, and we are almost certain the South Otago Districts. It crosses readily with *H. salicifolia* var. *communis;* for the series of hybrids we propose the name × *Hebe leiosala* Ckn. et Allan. and for the form intermediate between the parents × *Hebe Kirkii* (J. B. Armstg.) Ckn. et Allan as hybrid.

(*a.*) var. **strictissima** (Ckn.) Ckn. et Allan comb. nov. = *Veronica leiophylla* (Cheesem.) var. *strictissima* (T. Kirk) Ckn. in *The Cawthron Lecture* 1 (1920) 11.

This we believe to be *Veronica parviflora* Vahl var. *strictissima* T. Kirk the locality of which is given as Akaroa where, so far as we know, the only shrub which could fit Kirk's description is the Banks Peninsula form of *Hebe leiophylla*. This is not constant, but consists of more than one jordanon. Hybrids with *H. salicifolia* var. *communis* have not been recorded, but it is most unlikely that such do not occur, and those which come near to var. *strictissima* might quite well account for much of its diversity.

[***Veronica longiracemosa** Petrie in *Trans. N.Z. Inst.* 49 (1917) 52.]

This was based upon a cultivated plant which came from the garden of H. J. Matthews, who explained it had been collected by himself in the Awatere Valley (North-eastern District). Petrie remarks "it shows no signs of being intermediate between any of the larger-leaved species of the genus, and it seems impossible to me that it should be a hybrid." Cheeseman in the *Manual* ed. 2, refers it to *H. salicifolia* var. *paludosa.* Certainly Matthews's specimen is very like the last-mentioned plant, and if they are identical we think Matthews may have confused his localities, a quite possible mistake, since his garden plants were never labelled according to locality or habitat. On the other hand, the plant might be a form of × *Hebe leiosala* greatly resembling *H. salicifolia* var. *paludosa.* In any case it is not the type of a valid species.

[***Veronica gracillima** (T. Kirk) Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 510.]

Hebe angustifolia and *H. salicifolia* var. *communis* cross and form a polymorphic series of hybrids including the forms usually placed under *Veronica gracillima.* These are found not merely "in the vicinity of Westport," as stated in the *Manual* ed. 2, but they occur in abundance along the valley of the Buller and its tributaries, and probably throughout the North-western district, excepting its southernmost part, and extend into the western part of the Sounds-Nelson District. For the group we propose the name × *Hebe angustisala* Ckn. et Allan hyb. nov., while the name × *Hebe gracillima* (T. Kirk)

Ckn. et Allan as hybrid we apply to the small group of forms intermediate in character between the parents. Such of Townson's original specimens as we have seen show considerable diversity.

20. **Hebe insularis** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica insularis* Cheesem. in *Trans. N.Z. Inst.* 29 (1897) 392.

From the description this seems to be a compound species. It is confined to the Three Kings Islands and has only been seen wild by Cheeseman.

[***Veronica venustula** Col. in *Trans. N.Z. Inst.* 32 (1895) 393.]

Of this Colenso remarks " allied to *V. laevis* and to *V. buxifolia* but differing from them in several characters." By Cheeseman, who saw only " two small scraps," it is compared so far as inflorescence goes, with *Hebe diosmaefolia,* and by N. E. Brown of Kew it was considered " a very distinct species near to *V. diosmaefolia.*" Probably the collector—A. Olsen—took all the specimens from one plant. Our opinion is that the species is founded on altogether insufficient material and that it either comes into the compound species, *Hebe laevis,* or is a hybrid between this and *H. buxifolia.*

21. **Hebe diosmaefolia** (R. Cunn. ex A. Cunn.) Ckn. et Allan comb. nov. = *Veronica diosmaefolia* R. Cunn. ex A. Cunn. in *Bot. Mag.* (1836) sub. t. 3461.

This is a well-marked compound species the jordanons of which are yet to be defined, but more than one is in cultivation.

[***Veronica trisepala** Col. in *Trans. N.Z. Inst.* 15 (1883) 324.]

Cheeseman considered this the type of *H. diosmaefolia,* whereas Kirk reduced it to a variety of that species, which of course it would be, type or otherwise. It was based by Colenso on specimens taken, presumably from one plant, by A. Hamilton on the Kaweka Range far south of what was considered the southern limit of *H. diosmaefolia.* What the status of the so-called " species " is we do not know.

Cheeseman in reference to the above, *Manual* ed. 2, p. 798, considers it the " type " of *H. diosmaefolia* because it extends throughout " the whole range of the species while the form with a 4-partite calyx is rare in the wild state." But all this is beside the mark for, rare or otherwise, the type is the plant described by Allan Cunningham which neither Cheeseman nor any New Zealand student of *Hebe* has seen.

22. **Hebe Menziesii** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica Menziesii* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 512 (doubtfully of Benth. in *D.C. Prodr.* 10 (1846) 461.

We greatly doubt whether the species, as defined in the *Manual,* is Bentham's, which was based on material from Dusky Sound collected by Menzies. As defined by Cheeseman the species is common in the north of South Island and is readily recognizable. It is probably a compound species, as Cheeseman's indefinite diagnosis suggests, *e.g.* " racemes corymbosely branched, very rarely simple." One of

us has seen wild hybrids with *Hebe salicifolia* var. *communis* in one locality, but they are probably more or less common elsewhere, and F. G. Gibbs considers it crosses with *H. buxifolia.*

23. ***Hebe divaricata** (Cheesem.) Ckn. et Allan sp. nov. = *Veronica Menziesii* Benth. var. *divaricata* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 512.

We consider this a well-marked, easily-recognizable species. Cheeseman devotes five lines of small print to its description, so to him it did not come at all close to *H. Menziesii.* It is of extremely limited distribution and a companion plant of *H. rigidula.*

[***Veronica Colensoi** Hook f. in *Handbk. N.Z. Flora* (1864) 209.]

Hooker's species includes a mixture of various mountain forms of *Hebe,* the greater part of which had compound racemes. Cheeseman, having separated *H. Menziesii* and perhaps *H. rupicola* from the mixture, restricted the species to a plant collected on the Ruahine Mountains by Colenso which, according to N. E. Brown, is identical with Colenso's *Veronica Hillii.* Cheeseman describes the racemes as "simple or sparingly branched," but Hooker specially refers to the North Island plant as having simple racemes. Obviously the whole matter is far from satisfactory but, as we only know *V. Hillii* from a dried specimen, we can express no opinion about the validity of a species concerning which Cheeseman must have been far from satisfied since he writes, "If the name [*V. Colensoi*] is to be retained at all, it should clearly be restricted to Colenso's plant." In Petrie's herbarium, on the other hand, there are specimens from two different localities which apparently match one another, and a third specimen with branched racemes.

24. ***Hebe rigidula** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica rigidula* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 514.

This is an extremely well-marked, and apparently simple species. L. Cockayne (1916, p. 207) wrongly referred to this species a plant he saw in a garden in the Marlborough Sounds, supposed to come from a hill at the back of Wilson Bay, Pelorus Sound.

25. ***Hebe rupicola** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica rupicola* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 514.

This apparently simple species is probably confined to rocks in the North-eastern Botanical District, or at its junction with the North-western.

26. ***Hebe laevis** (Benth.) Ckn. et Allan comb. nov. = *Veronica laevis* Benth. in *D.C. Prodr.* 10 (1846) 461.

The species was based by Bentham on specimens collected near Mount Tongariro by Bidwill. In the *Handbook* Hooker added specimens collected in the mountains of Nelson to the species, and stated that it passed into *V. buxifolia* and *V. carnosula.* This widening of the conception of the "species" by Hooker led—as such procedure usually did—to a conception wider still based on the belief in "variation," and Armstrong recorded it as fairly common for Canterbury,

Cheeseman as occurring on various mountains in Nelson, Kirk as extending from Nelson to Southland, and Petrie as being in the far west of Otago—but the latter botanist was "not quite certain of the identification of this species." In the first edition of the *Manual* Cheeseman, apparently assisted by N. E. Brown, took the bold step of restricting the species to the North Island series of forms of which the original specimens gathered by Bidwill were the type; but though he specially mentions this restriction and declares he has seen no South Island specimens that "satisfactorily *match those from the* North Island," he adds specimens collected by Macmahon on Mount Duppa (Sounds-Nelson Botanical District)! We are well acquainted with the species as it occurs in the Volcanic Plateau Botanical District. There it is a compound species and crosses readily with *Hebe salicifolia* and almost certainly with *H. buxifolia.* We also think there are forms of the species in South Island, but this requires field observations and garden experiment.

[***Veronica Carsei** Petrie in *Trans. N.Z. Inst.* 55 (1924) 96.]

Hebe laevis forms polymorphic hybrids with *H. salicifolia* when these species come together on the Volcanic Plateau. *Veronica Carsei* is merely one of the hybrid group, vegetatively closer to *H. laevis,* but with the inflorescence more like that of *H. salicifolia.* For the group of hybrids we propose the name × *Hebe laevisala* Ckn. et Allan, and if × *Hebe Carsei* forms a fairly distinct subgroup—but not otherwise—that name should be adopted for such. Cheeseman, accepting the species, calls it "a very puzzling plant" related to *Veronica Mathewsii.*

27. **Hebe elliptica** (Forst. f.) Pennell in *Rhodora* 23 (1921) 39.

This is a well-marked compound species made up of at least three jordanons. It hybridizes readily with *Hebe salicifolia,* and in situations exposed to gales may form prostrate or semi-prostrate epharmones. Judging from a specimen most kindly given us by Skottsberg one of the jordanons is common to Subantarctic South America and New Zealand.

(*a.*) **Hebe elliptica** (Forst. f.) Pennell var. **crassifolia** Ckn. et Allan var. nov.

Ramuli hornotini pallide virides, ± 3 mm. diam., pubescentes; folia conferta ± 2.7 cm. longa, ± 1.5 cm. lata, glabra, supra intense viridia nitentia, ± 2 mm. crassa, sub-succulenta; alabastra cremea, flores albi; bracteae linearo—oblongae sub-acutae; calyx profunde lobatus, lobis oblongis, abrupte acutis; corollae lobi late ovati.

North Island: Ruahine-Cook Botanical District—Kapiti Island, L. J. Wild, H.H.A.; Titahi Bay, Aston, L.C., H.H.A.

This variety appears to be confined to coastal rocks, and as seen wild is so distinct, with its thick, almost succulent, dark-green, glistening leaves, pale-green branchlets, few-flowered racemes of large white flowers, with broad corolla-lobes, that it might be considered preferable to give it specific rank. The thickness of the leaves is due to the great development of water-storage tissue, and in cultivation inland the leaves become much paler and thinner,

but remain abundantly distinct from those of any other jordanon of the compound species, as can be recognized at a glance when these are grown together with it. At Titahi Bay many of the individual plants are attacked by a leaf-bud disease, and a number have died out since the junior author's first examination of the locality in 1924. The Kapiti Island plants have rather narrower leaves, and less pubescent branchlets, but are too close to those of the mainland to warrant separation as a variety, indeed the differences may be merely epharmonic.

[***Veronica Matthewsii** Cheesem. in *Man. N.Z. Flora* (1906) 517.]

If the specimens cited by Cheeseman from the Southern Alps, Milford Sound, and the Humboldt Mountains are one and the same as the garden plant so well known as *V. Matthewsii*, which has all been raised vegetatively from *one* individual, then the species is certainly both a simple one and most distinct. But we have never seen anything approaching the garden plant in the localities mentioned, while the latter exactly matches the diagnosis; nor are the wild specimens in Petrie's herbarium at all convincing. For the present we exclude *V. Matthewsii* from our list of indigenous species, as being unproven.

[***Veronica Balfouriana** Hook f. in *Bot. Mag.* (1879) t. 7556.]

This is merely a cultigen, raised in the Royal Botanic Gardens, Edinburgh, from seed sent from New Zealand, and must be excluded from the flora. A specimen in Petrie's herbarium has the appearance of a hybrid with *H. vernicosa* as one of the parents.

[***Veronica Darwiniana** Colenso in *Trans. N.Z. Inst.* 25 (1893) 332.]

This was founded by its author on specimens he collected "On hills in the interior, Hawkes Bay." He further states of it, "*A primâ facie* near to *V. Colensoi* Hook., but differing in several particulars." Until the whole group of these glaucous and semi-glaucous plants of North Island are studied afresh we cannot uphold the present as a valid species.

[**Veronica glaucophylla** Ckn. in *Trans. N.Z. Inst.* 31 (1899) 422.]

Although L. Cockayne noted many shrubs growing in the same locality and habitat (Craigieburn Mountains, Eastern Botanical District) more or less similar to the one he described, the diagnosis refers only to a shrub he had brought into his garden, and used as a type. But whether that type was really a species or a hybrid we have not the least idea. Hebes of a similar character grow abundantly in shrubland on the mountains near Hanmer, but they form a polymorphic group. There are certainly present crosses between a glaucous-leaved *Hebe* and *H. Traversii*, but it cannot be said, with our present knowledge, that this glaucous plant is *Veronica glaucophylla* Ckn. Cheeseman did not hesitate to unite all these glaucous-leaved Hebes, together with *Veronica Darwiniana*, into an aggregate species, but this procedure is an exact example of that artificial taxonomy which we decry. *V. glaucophylla*, or a near relative, is known in most nursery gardens as *V. Colensoi* var. *glauca*.

28. ***Hebe Traversii** (Hook f.) Ckn. et Allan comb. nov. = *Veronica Traversii* Hook. f. in *Handbk. N.Z. Flora* (1864) 208.

The species, as constituted by Hooker, is an extensive linneon without a type. In the *Manual* ed. 1, p. 518, Cheeseman emended the species, selecting as his type the plant figured in the *Botanical Magazine* t. 6390. Even as emended the species remains a linneon. From field-observations we are certain that there are various jordanons in the conception of the species, that these cross amongst themselves, with the glaucous-leaved species, with *H. leiophylla, H. montana,* and probably with *H. salicifolia* var. *communis,* and other species. We have seen astonishing mixtures in certain pieces of shrubland where *Hebe* dominates, and suspect that proper analysis would reveal the existence of trihybrids, and even more complicated admixture of "blood."

[var. *fallax* Cheesem. and var. *elegans* Cheesem.—both in *Man. N.Z. Flora* ed. 1 (1906) 519.]

We do not know for certain either of these varieties. If var. *fallax* is common, as we gather from Cheeseman's remarks, it is certainly compound. The other variety is said to be a local plant. Obviously the whole linneon demands searching investigation.

[**Veronica rakaiensis** J. B. Armstg. in *Trans. N.Z. Inst.* 13 (1881) 356.]

Judging from what is almost certainly a co-type in the Herbarium of the Dominion Museum this is identical with or close to *Hebe Traversii* var. *elegans* Cheesem. Petrie, however (1917, p. 53), refers a plant collected near Queenstown (South Otago Botanical District) to Armstrong's species, but he compares it with *Hebe pinguifolia,* to which surely *V. rakaiensis* has no affinity.

29. **Hebe evenosa** (Petrie) Ckn. et Allan comb. nov. = *Veronica evenosa* Petrie in *Trans. N.Z. Inst.* 48 (1916) 189.

We are not at all sure we do right in upholding this as a species. In Petrie's herbarium there are evident differences in his specimens. Also, judging especially from the form in cultivation, we are not at all sure that *H. evenosa* and *H. subalpina* are not one and the same. A searching study of the Ruahine-Tararua forms of *Hebe laevis* and this under consideration is greatly needed. The junior author has recently studied a *Hebe* community on the Ruahine Mountains that has been induced by the burning of subalpine scrub. The bulk of the plants are referable to *H. laevis* along with some *H. salicifolia.* Dotted about are plants that might well be accepted as *H. evenosa,* and they show only minor differences amongst themselves. A hybrid origin is strongly suggested, and the comparative uniformity would not be unexpected in plants of the F_1 generation. Selected specimens are being cultivated.

30. **Hebe subalpina** (Ckn.) Ckn. et Allan comb. nov. = *Veronica subalpina* Ckn. in *Trans. N.Z. Inst.* 31 (1889) 420.

This is a well-marked species, probably compound, but, if so, with very similar jordanons. We cannot agree with Cheeseman's remark

"very close to *V. Traversii*," for its principal characters are very different, it can be recognized at a glance, comes much earlier into bloom, and is a shrub of an extremely wet climate, whereas *H. Traversii* is usually of a fairly dry climate. In nursery gardens it generally bears the name *Veronica Colensoi* var. *viridis*. It probably crosses with *Hebe salicifolia* var. *communis*.

31. **Hebe vernicosa** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica vernicosa* Hook. f. in *Handbk. N.Z. Flora* (1864) 208.

For many years this species was misunderstood by New Zealand taxonomists with the exception of Cheeseman, who most likely knew the true group from his study of the Nelson flora (1882, p. 317); in fact a form of *Hebe buxifolia* with twiggy stems and rather narrow, patent leaves was referred to *H. vernicosa*, the true species having, in part, been described by J. B. Armstrong (1879, p. 58) as *Veronica canterburiense* (sic). T. Kirk (1896, p. 526), who had consulted N. E. Brown of Kew on the matter, brought the true *Hebe vernicosa* to the light, stating "it must be remarked that until of late years *V. vernicosa* has not been understood by New Zealand botanists, *V. odora* Hook. f. [which Kirk considered a var. of *V. buxifolia*] having been mistaken for it, an error in which the authorities at Kew appear to have participated for a time."

Hebe vernicosa is a well-marked compound species made up of several jordanons. Cheeseman's citation of localities: "Mountain districts in Nelson, Marlborough, Canterbury and Westland" is misleading; for though it occurs in the northern parts of the two last, it does not extend to any distance south of Arthur's Pass, *e.g.* Wall does not record it from Mount Cook, nor Cockayne and Laing from the sources of the Rakaia. Hooker evidently had no type but Cheeseman takes as his type *Veronica canterburiensis*, as so labelled in the Christchurch botanic garden, where, however, the labels constantly misplaced are misleading, and Armstrong's original labels no longer exist. At any rate, Cheeseman undoubtedly meant the Arthurs' Pass plant, which we cite below as var. *canterburiensis*, to be his type.

(*a.*) var. *canterburiensis* (J. B. Armstg.) Ckn. et Allan var. nov. = *Veronica canterburiensis* J. B. Armstg. in *N.Z. Country Journ.* 4 (1879) 58.

This is the sole variety in the vicinity of Arthur's Pass and the adjacent mountains of the Western Botanical District. It is usually smaller and of more prostrate habit than the other varieties of the species. Cheeseman gives a wrong citation for the original publication of the species.

(*b.*) var. *gracilis* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica vernicosa* Hook. f. var. *gracilis* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 520.

This appears to be the common form of the Sounds-Nelson Botanical District, and it is probably compound. It is certainly not the same jordanon or group of such as var. *canterburiensis*. Cheeseman speaks of it as a "shade-form," but whether he means it is more or less confined to shady places but fixed in form, or an epharmone

due to shade, we cannot say, but though growing within the forest, it also is common enough when exposed to full sunshine.

[var. *multiflora* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 520.]

Cheeseman knew this merely as a garden plant. Certainly it is common enough in cultivation and constant in form because of its vegetative propagation. Most likely it could be matched from wild plants, but until that is proved the name should not be used floristically.

[**Veronica Greyi** J. B. Armstg. in *N.Z. Country Journ.* 3 (1879) 57.]

According to our remembrance of plants cultivated in the Christchurch Botanic Garden under this name the above was a form—far from luxuriant—of *Hebe vernicosa.* On the other hand Cheeseman states the var. *multiflora* bears the name *V. Greyi* in gardens but he is not quite sure if it is Armstrong's species.

[**Veronica obovata** T. Kirk in *Trans. N.Z. Inst.* 9 (1877) 502.]

This was based by Kirk apparently on one plant noted by him at Broken River (Canterbury). Cheeseman created a compound species by adding three more plants to the species, and was inclined to think the species, as so constituted, might be combined with *H. montana.* Considering the great diversity that arises from crossing, all four plants might quite well have been hybrids, and with the death of the original plants, no more specimens exactly matching them might ever be found again. With our present knowledge of the genus we consider that the species is not well founded, and that it should be removed from the flora.

[***Veronica Godfroyana** Carrière in *Revue Hort.* (1888) 455.]

For most of the particulars regarding this plant we are indebted to Professor W. Wright Smith (Regius Keeper, Royal Botanic Garden, Edinburgh) who sent us a copy of the original description. The "species" is not mentioned in either edition of the *Manual,* but its leaf-anatomy was dealt with by R. S. Adamson (1912) who classed it along with the glaucous-leaved species together with *Hebe buxifolia, H. Menziesii* and *H. montana.* The plant is merely a cultigen evidently raised from seed sent from New Zealand. From Carrière's description the original plant apparently came into the *Hebe glaucophylla* group. The description was drawn up from a plant in the garden of M. Godefroy-Lebeuf at Argenteuil. The senior author has three plants in his garden which he raised from seed collected in the Royal Botanic Garden, Edinburgh, which have not yet flowered. All are of a similar type and come well into the conception of *Veronica obovata* (which see) but they put us greatly in mind of certain wild hybrids between *Hebe Traversii, H. montana* (certain of its forms) and *H. pinguifolia.* From the above it seems likely the plant is of hybrid origin.

32. **Hebe montana** (J. B. Armstg.) Ckn. et Allan comb. nov. = *Veronica montana* J. B. Armstg. in *N.Z. Country Journ.* 3 (1879) 58.

Armstrong, in redescribing the species in *Trans. N.Z. Inst.* 13 (1881) 354, altered the name to *monticola*, but the prior name must stand for *Hebe*. The descriptions given by Armstrong and by Cheeseman differ considerably, the latter having extended the conception of the species to include, apparently, all forms of *Hebe* resembling *H. Traversii*, but with a shorter inflorescence. Thus defined, the species becomes a linneon of which the jordanons are not known, and in which hybrids play no small part. Much field work will be required to disentangle the group. Possibly as so much confusion attends the use of the name, it will ultimately be abandoned.

33. ***Hebe Cockayniana** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica Cockayniana* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 522.

This species was based on specimens from one plant collected by L. Cockayne, not on the Humboldt Mountains, as given by Cheeseman, but in the cirque at the head of the Earnslaw Creek, together with specimens from the North-western Botanical District and one from the Clinton Valley. It apparently comes nearest to *H. Willcoxii*. Judging from the specimens in Petrie's herbarium the species is probably compound.

34. ***Hebe buxifolia** (Benth.) Ckn. et Allan comb. nov. = *Veronica buxifolia* Benth. in *D. C. Prodr.* 10 (1846) 462.

Bentham based his species on specimens from Mount Egmont, but as now recognized it is a huge linneon, made up of many jordanons and their hybrids. The jordanons fall into groups, of which (1) the *dense ball-like* form, (2) the *prostrate* form, and (3) the *erect sparsely-branched* form are distinct enough to form compound varieties. How polymorphic is the linneon appears from the fact that on the Rock and Pillar Range there was noted by L. Cockayne a pure colony, which had established itself after fire, and from which form after form of great diversity could be selected. Evidently there was a mixture of jordanons and their hybrids of various generations. Fortunately we have several of these plants growing well in readiness for taxonomic experiments.

(*a.*) var. *odora* (T. Kirk parte) Ckn. et Allan comb. nov. = *Veronica buxifolia* Benth. var. *odora* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 522, excluding *Veronica odora* Hook. f.

Cheeseman changed the name to *patens*, since Kirk had included *V. odora* Hook. f. in his variety *odora*, but as Kirk also included one or more forms of *Hebe buxifolia*, we must uphold his varietal name for the amended variety. It is certainly, however, a compound variety made up of jordanons and their hybrids, and needs further analysis.

(*b.*) var. *prostrata* (Ckn.) Ckn. et Allan comb. nov. = *Veronica buxifolia* Benth. var. *prostrata* Ckn. in *Rep. Bot. Surv. Stewart Id.* (1909) 44.

This is not mentioned in the *Manual* ed. 2, but it is certainly a distinct variety and not an epharmone. Probably it is best not to restrict the name to the type but to group together as a compound

variety all the prostrate non-epharmonic forms of the species, but this matter can be settled only by observations and experiments.

(*c.*) var. *pauciramosa* Ckn. et Allan in *Trans. N.Z. Inst.* 56 (1925) 27.

The type is a living plant in L. Cockayne's garden, but the variety is intended to be a compound one, including the erect, sparsely-branching forms in general. Were there no transitional jordanons between this and var. *odora* and its allies, var. *pauciramosa* is so distinct that it might be considered a species. The whole linneon is, however, so well-marked by the spicate inflorescence, furnished with leaf-like bracteoles resembling the foliage leaves, that any variety or jordanon can be at once recognized as belonging to the compound species.

[**Veronica odora** Hook f. in *Fl. Antarct.* 1 (1844) 62, t. 41.]

There can hardly be a doubt that plate 41 of the *Flora Antarctica* vol. 1 represents a common form of *Hebe elliptica,* and in addition Hooker describes the flowers as having the sweet scent of those of that species. In the *Handbook,* p. 210, however, he treats *V. odora* as a synonym of *V. buxifolia* Benth. Aston collected specimens in Lord Auckland Island that did not match *H. elliptica* but were nearer to *H. buxifolia.* These were considered by Cheeseman to be identical with Hooker's var. *odora,* and he restored the species in *Subant. Islds. of N.Z.* 2 (1909) 424, and in the *Manual* ed. 2. L. Cockayne also submitted to Cheeseman specimens collected in Stewart Island that he considered a variety—using the term in a general sense—of *V. odora,* but this locality is omitted in the *Manual* ed. 2. There appears to be more than one jordanon of *H. elliptica* on Lord Auckland Island, which probably hybridize, and it seems to us that the original *V. odora,* in part at least, belonged to this group, and that there is another species present, evidently quite rare (represented most likely by Aston's specimens), related to *H. buxifolia.* Possibly, even, Hooker's *V. odora* is a hybrid form between these. To clear up this involved matter evidently requires a detailed investigation of the Hebes of the island.

[**Veronica anomala** John F. Armstrong in *Trans. N.Z. Inst.* 4 (1872) 291. *Veronica anomala* J. B. Armstrg. in *Trans. N.Z. Inst.* 13 (1881) 355 as sp. nov.]

Armstrong *père* described as a new species a plant from "Head waters of the River Rakaia," but does not name the collector, although this is given for all the other species described in the paper. "In foliage it much resembles *V. vernicosa* [meaning thereby slender *Hebe buxifolia*], and in the corolla has some distant resemblance to *V. Colensoi.* It may prove to be an hybrid between these two species." Armstrong *fils* describes *V. anomala* as a new species, and gives a description matching that of the earlier one, but with further details. He gives as habitats "Canterbury Provincial District, Rakaia Valley, Mount Cook, and Mount Peel." He describes the capsule (not seen by J. F. A.) as "pubescent." Cheeseman's description in *Man. N.Z. Flora* ed. 1 (1906) 523 resembles that of J. B. Armstrong, except that he describes the capsule as "glabrous." He repeats his description in *Manual* ed. 2, but accepts only the "Rakaia Valley" habitat as

authentic, attributing the original collection to J. B. Armstrong, and another to E. Stead. He remarks "quite common as a garden-plant, but very rare in the wild state. The few wild specimens that I have seen agree with Mr. Armstrong's description in the total suppression of the anticous lobe of the corolla, but cultivated specimens are variable in this respect." Were it not that the senior author has seen a specimen collected by E. Stead in the Rakaia Gorge, which he referred to *V. anomala*, but perhaps wrongly, we should have no hesitation in removing the species from the flora, as it is otherwise only known as a garden plant. The junior author, during a long-extended examination of Mount Peel, failed to find it there, though a narrow-leaved jordanon of *H. buxifolia* occurs that has some slight resemblance to the garden plant. Nor does Wall (1925) record it from Mount Cook. The plant is amply distinct, but may quite well be of hybrid origin, and at present we do not accept it as a proved species. Even if found wild it would be best treated as a variety of *Hebe buxifolia.*

35. **Hebe decumbens** (J. B. Armstr.) Ckn. et Allan comb. nov. = *Veronica decumbens* J. B. Armstr. in *N.Z. Country Journ.* 3 (1897) 57.

This is an easily recognized, probably compound species. Cheeseman in the *Manual* ed. 2 considered Armstrong's description "by no means good," but to us, and we have seen the species in its habitat again and again, it appears satisfactory enough. We have no definite field information regarding its polymorphy but it probably crosses with one or more species and it certainly forms far from a uniform population.

36. **Hebe Willcoxii** (Petrie) Ckn. et Allan comb. nov. = *Veronica Willcoxii* Petrie in *Trans. N.Z. Inst.* 45 (1913) 272.

This is a well-marked, perhaps simple, species. So far it has only been found at the head of the Routeburn (Fiord District), but a specimen collected by J. Scott Thomson on Cecil Peak (South Otago District) may belong here. No hybrids have been noticed. Petrie and Cheeseman consider it related to *H. decumbens* but we place it near *H. Cockayniana.*

37. ***Hebe Gibbsii** (T. Kirk) Ckn. et Allan comb. nov. = *Veronica Gibbsii* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 524.

This very distinct, simple species appears to be confined to Mounts Rintoul and Ben Nevis (Sounds-Nelson District). We have not seen it wild. In Petrie's herbarium there is a specimen from H. J. Matthews's garden which appears to be a hybrid with *H. Gibbsii* as one of the parents.

[***Veronica carnosula** Hook f. in *Handbk. N.Z. Flora* (1864) 210.]

We are not prepared to recognize this as a valid species for the reasons given below, and think that the specimens dealt with by Hooker were quite likely hybrids. In the *Flora Novae-Zelandiae* 1 (1853) 194 Hooker described his *Veronica laevis* Benth. var. β *carnosula* from specimens collected by Bidwill in "Nelson, mountains, 2—6,000 ft." In the *Handbook* he raised the variety to specific rank, basing his description, not on material from Nelson generally,

but on specimens collected by Bidwill on " Morses Mountain 5,000 ft." (wherever that may be!), together with specimens collected by Monro at the " Upper Wairau." He states " from *V. pinguifolia* the ovary and capsules alone distinguish it." Cheeseman in the *Manual* ed. 2, p. 811, gives as localities " Mountain districts from Nelson to Otago, but apparently not so abundant as *V. pinguifolia,*" and says " very closely allied to *V. pinguifolia,* differing mainly in the rather larger ovate-acute glabrous capsule."

Now, so far as we know, the linneon called *Veronica pinguifolia* does not occur in Nelson. What does occur is an astonishing mixture of glaucous-leaved shrubs, ranging from prostrate to erect with leaves of many shapes, and with no real uniformity in inflorescences or flowers. In all cases where we have examined the capsules they have been glabrous, and it is this character alone which marks off the " species " from *V. pinguifolia.* Such a series must be a swarm of hybrids along with the parents. Without the most detailed field-observations in many localities, checked by breeding experiments, it seems to us altogether impossible to separate the mass of diverse forms into its constituent parts. To say that here we have a " variable " species, and that because the glabrous capsule is a common character we have various " varieties " of *V. carnosula* leads nowhere, except back into the morass from which we are trying to escape. Much easier, indeed, and quite as logical, would it be to lump together all these prostrate, semi-prostrate, and small erect forms of *Hebe* into one " variable species," in which the capsule is either hairy or glabrous! How out of such a mixture would the original collectors select the jordanons rather than their hybrids? To Hooker or anyone working by the herbarium method jordanon or hybrid would be equally material for description, and if very limited in quantity would look quite as uniform, if not more so, than the heterogeneous mass of material he was attempting by the herbarium method to classify.

We have gone into this case at such length, not to belittle the labours of the past, but because it is typical of no small amount of taxonomic work *still* being carried on, and because on what is stated above hangs the fate of the next " species."

[**Veronica albicans** Petrie in *Trans. N.Z. Inst.* 49 (1917) 53.]

This was based by Petrie on a plant he saw in Mr. F. G. Gibbs's garden that had been collected by Gibbs as a chance young plant on Mount Cobb (Nelson) where there is that diversity in *Hebe* detailed for *Veronica carnosula,* together with specimens collected by H. J. Matthews on Mount Arthur—another centre of extreme diversity. Petrie's description and specimens he sent to us, together with those in his herbarium, show that the plants he relied on differed in certain respects. It seems most unlikely that from a heterogeneous collection of forms of *Hebe* both Gibbs and Matthews should have gathered an identical form. To us *V. albicans* is probably a hybrid, or two hybrids, belonging to the unresolved *V. carnosula* group. Gibbs had another *Hebe* in his garden collected at the same time and place. It differed greatly from *V. albicans,* though sufficiently close for the two to be

merged together as a "variable species," under the old conceptions governing such.

[***Veronica Biggarii** Ckn. in *Trans. N.Z. Inst.* 48 (1916) 199.]

This was based on a plant cultivated in D. L. Poppelwell's garden, raised from a cutting collected by Popplewell on the Eyre Mountains (South Otago Botanical District). Cheeseman in the *Manual* ed. 2, included a plant collected on Mount Dick by L. Cockayne, speaking of it as a small variety with shorter rounder leaves. There is evidently present in the mountains bordering Lake Wakatipu a distinct compound species, but as it is by no means certain that the type plant was a jordanon rather than a hybrid, we suggest that the name should be rejected until adequate field observations can be made. Or if it is considered desirable to uphold the group of plants approximating to the type as a species, its content must be increased in the usual manner; in fact Cheeseman led the way in this direction in the *Manual* ed. 2. Cheeseman groups *V. Biggarii* along with *V. amplexicaulis* and *V. albicans,* but it is certainly far removed from these and comes not very distant from *Hebe pimeleoides* var. *rupestris.*

38. ***Hebe pinguifolia** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica pinguifolia* Hook. f. in *Handbk. N.Z. Flora* (1864) 210.

This is a linneon of probably many jordanons, and their hybrids; and in its widest conception there will be hybrids between *H. montana, H. Traversii,* and perhaps other species. A vast amount of field work and genetic experiment will be required to arrive at the status of the different members of the linneon. On Mount Misery, not far from the Cass Biological Station of Canterbury College, there is an extraordinary mixture of diverse forms growing in a limited area, which could be studied with ease. Cheeseman gives Otago as a locality for the species, but we do not think it is to be found there.

39. ***Hebe Buchanani** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica Buchanani* Hook. f. in *Handk. N.Z. Flora* (1864) 211.

This is a well-marked compound species, or, as treated by Cheeseman, linneon. From the southern part of the Eastern Botanical District southwards it is the representative of *H. pinguifolia.* By Petrie (1896) only the last-named is cited for Otago, but Cheeseman refers most of those forms so-called to *H. Buchanani.*

[var. *major* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 527.]

This may be *H. Buchanani* × *pinguifolia,* for Cheeseman says it might be referred to either species.

(*a.*) var. *exigua* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica Buchanani* Hook. f. var. *exigua* Cheesem. in *Man. N.Z. Flora* ed. 1 (1906) 527.

This is possibly one of the jordanons, since it is supported by specimens collected near Mount Cook by three collectors and, apparently, it and var. *major* are the sole representatives near Mount Cook. On the contrary, Buchanan's original specimen from Mount Alta is

what Cheeseman calls " an extreme state " which may quite likely be dependant upon its special habitat. In short, the species is in a most unsatisfactory taxonomic state and badly requires well-directed study in the field without reference to the few specimens at present in herbaria which are a danger rather than an assistance.

40. **Hebe Treadwellii** Ckn. et Allan in *Trans. N.Z. Inst.* 56 (1925) 27.

This is a distinct species, with green not glaucous leaves, allied to *Hebe pinguifolia,* but distinguished from all forms of that compound species by several well-marked characters.

[**Veronica haustrata** J. B. Armstg. in *N.Z. Country Journ.* 3 (1879) 58.]

This is not mentioned in either edition of the *Manual,* nor did Armstrong himself include it in his list of the species of *Veronica* published two years later, but it appears in his catalogue of the plants of Canterbury (1880) and is placed between *Hebe buxifolia* and *H. carnosula,* all of which come under his degree of frequency as " local." What the plant is we have no idea, but certainly it would not be difficult to find specimens answering fairly well to the description. It seems to come nearest to *H. Treadwellii* and might indeed be identical, but the latter name must stand for the present.

41. **Hebe amplexicaulis** (J. B. Armstr.) Ckn. et Allan in *Trans. N.Z. Inst.* 56 (1926) 26 = *Veronica amplexicaulis* J. B. Armstr. in *N.Z. Country Journ.* 3 (1879) 56—this original citation not in the *Manual.*

For a long time this was known only as a garden plant, evidently propagated by cuttings from J. F. Armstrong's original specimen from the Rangitata (Eastern Botanical District). In 1911 Cockayne and Laing referred a plant from the Upper Ashburton to this species, but the specimen is not to hand, and we cannot vouch for the correctness of the identification. During the years 1917 to 1921 H. H. Allan found a number of plants on Mount Peel (Eastern Botanical District) that evidently should be included in the conception of the species as a distinct jordanon. This plant is abundant on rocky outcrops on all parts of the mountain up to about 1200 m., and exhibits none but epharmonic differences. He further found a perfectly erect, almost ball-like, jordanon sparingly in the Upper Rangitata. We have treated the compound species in an earlier paper (1925).

(*a.*) var. *vera* Ckn. et Allan in *Trans. N.Z. Inst.* 56 (1925) 26.

This is the type plant known in cultivation. We have not seen it wild.

(*b.*) var. *suberecta* Ckn. et Allan in *Trans. N.Z. Inst.* 56 (1925) 26.

This is the decumbent or straggling rock-plant of Mount Peel. In cultivation it becomes rather more compact, with less extent of naked branches. It is certainly a distinct true-breeding jordanon.

(*c.*) var. *erecta* Ckn. et Allan in *Trans. N.Z. Inst.* 56 (1925) 26.

Only a few plants of this have been noted, but they appeared to be identical in their characteristics.

42. **Hebe Allanii** Ckn. in *Trans. N.Z. Inst.* 56 (1925) 25.

This is a very distinct, and so far as we know simple species. It is closely allied to *H. amplexicaulis* var. *suberecta*, and hybridizes readily with it. The intense hairiness of nearly all its parts, and the spreading forked branches giving a flat top to the shrub when fully developed, are its best distinguishing features.

43. ***Hebe pimeleoides** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica pimeleoides* Hook. f. in *Flora Nov-Zel.* (1853) 195.

This species, as described by Hooker in the *Flora Novae-Zelandiae*, is stated to have been collected by Lyall at Port Cooper. That is, it presumably came from the Port Hills. But Lyall and others made an excursion inland to near what is now Culverden, and the plant may have been collected at that time. Hooker remarks of it " A very small shrub, a span high, resembling *Pimelea prostrata*," and " A remarkably distinct little species." In the *Handbk. N.Z. Flora* (1864) 211, he gives a number of new localities for the species, " stony flats on the Hurumui (*sic*) mountains, alt. 800-1000 ft., Travers; Southern Alps, amongst shingle and grass, Hopkins, Godley, and Macaulay rivers, alt. 2-4000 ft., *Haast*," and says that it is allied to *V. pinguifolia*, "but more so to *V. Lavandiana*, etc."—a remarkable comparison! In the appendix to the *Handbook* he makes a var. *minor*, defined as " Smaller, leaves lanceolate, acute ⅙ in. long," based on specimens collected by Haast on " Shingle beds near Lake Heron."

Now all the localities and habitats given by Hooker correspond to those where what has always been called var. *minor* is found (L. Cockayne has actually seen the Lake Heron plant), and we submit that this is the type, and that the larger plant so common in Central Otago, usually considered the type, should be treated as a new variety, for which we propose the name *rupestris*, since it always grows in rocks. *Hebe pimeleoides*, as treated by us, is thus a compound species with the following known varieties.

(*a.*) *var. *minor* (Hook. f.) Ckn. et Allan comb. nov. = *Veronica pimeleoides* Hook. f. in *Handbk. N.Z. Flora* (1864) 738.

As already stated we consider this the type, but since in our system of nomenclature a varietal name is required for such in compound species Hooker's name " *minor* " is retained.

(*b.*) var. *glauco-caerulea* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica glauca-caerulea* J. B. Armstrg. (spelling altered subsequently to *glauco* by its author) in *N.Z. Country Journ.* 3 (1879) 57.

According to J. B. Armstrong this was collected by J. F. Armstrong in the Upper Rangitata, and by its author in the Waimakariri. We know it only as a most distinct garden plant, always the same, through its vegetative propagation. In the Waimakariri var. *minor* seems to be the only form, so we suppose that the garden plant is descended vegetatively from that of the Rangitata. Cheeseman gives no localities for either of the varieties, but his description is evidently that of the garden plant. It possibly would be best to exclude this from the flora.

(*c.*) *Hebe pimeleoides* Ckn. et Allan var. *rupestris* Ckn. et Allan var. nov. = *Veronica pimeleoides* Cheesem. in *Man. N.Z. Flora* ed. 2 (1925) 813 (*varietatibus exceptis*).

Fruticulus semi-erectus, patulus, gracilis, ± 45 cm. altus; folia obtusa, quam illa var. *minoris* majora; inflorescentia item majora.

The specific description of the *Manual* ed. 2, applies to this, probably compound, variety. There are many differences of a minor character amongst the individuals.

[**Veronica Dartoni** Petrie in *Trans. N.Z. Inst.* 55 (1924) 98.]

We strongly suspect that this is a hybrid between *Hebe pimeleoides* var. *rupestris* and *H. salicifolia* var. *communis.* It is not usual for these species to come together, so the hybrids will be scarce.

44. ***Hebe ciliolata** (Hook. f.) Ckn. et Allan comb. nov. = *Logania ciliolata* Hook. f. in *Handbk. N.Z. Flora* (1867) 737. Syn. *Veronica Gilliesiana* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 519.

This is a simple species, and as Cheeseman says, " quite unlike any other."

45. ***Hebe tetrasticha** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica tetrasticha* Hook. f. in *Handbk. N.Z. Flora* (1864) 212.

This is a simple species, allied to the next.

46. ***Hebe Cheesemanii** (Buch.) Ckn. et Allan comb. nov. = *Mitrasacme Cheesemanii* Buch. in *Trans. N.Z. Inst.* 14 (1882) 348, t. 29, f. 2. Syn. *Veronica quadrifaria* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 521.

This simple species, though allied to *Hebe tetrasticha* is clearly differentiated.

47. ***Hebe tumida** (T. Kirk) Ckn. et Allan comb. nov. = *Veronica tumida* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 521.

This is probably a simple species, but our knowledge of it in the field is insufficient to be certain. We suspect that it hybridizes with another, probably undescribed, whipcord *Hebe* of the same localities in the Nelson mountains.

48. ***Hebe tetragona** (Hook.) Ckn. et Allan comb. nov. = *Veronica tetragona* Hook. in *Icon. Plant.* (1843) Pl. t. 580.

This distinct simple species crosses occasionally with *Hebe laevis.* One of the hybrids was erroneously described by L. Cockayne (1912, p. 45) as a fixed or semi-fixed juvenile form of *H. tetragona,* which it greatly resembles.

49. **Hebe Astoni** (Petrie) Ckn. et Allan comb. nov. = *Veronica Astoni* Petrie in *Trans. N.Z. Inst.* 40 (1908) 288.

This apparently simple species is amply distinct from *H. tetragona.* It crosses with *H. laevis,* and for the group of hybrids we propose the name × *Hebe laevastoni* Ckn. et Allan.

50. ***Hebe lycopodioides** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica lycopodioides* Hook. f. in *Handbk. N.Z. Flora* (1864) 211.

Whether the series of plants from many localities described by Hooker as *V. lycopodioides* consisted of identical individuals or not we, of course, have had no opportunity of finding out. But *Hebe lycopodioides* as known in herbaria and in the field is a compound species, which badly needs separating into its varieties. The sudden narrowing of the leaf into a short point marks off the compound species from any other of the whipcord Hebes.

51. ***Hebe Hectori** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica Hectori* Hook. f. in *Handbk. N.Z. Flora* (1864) 212.

This is a well-marked, probably compound, species; there appear to be considerable differences in the diameters of the shoots, as also in the leaves.

52. **Hebe coarctata** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica coarctata* Cheesem. in *Man. N.Z. Flora* (1906) 531.

We have not seen this in the field. Cheeseman states, "it appears to be intermediate in characters between *V. Hectori* and *V. Armstrongii.*" It is confined to the North-western Botanical District.

53. **Hebe Laingii** (Ckn.) Ckn. et Allan comb. nov. = *Veronica Laingii* Ckn. in *Rep. Bot. Surv. Stewart Id.* (1909) 44.

This apparently distinct, simple species has been recorded only from near the summit of Mount Anglem, Stewart Island. Most likely it will be found to also occur in the Fiord Botanical District. In gardens a hybrid whipcord *Hebe* with no resemblance whatsoever to *H. Laingii* is frequently cultivated under that name!

54. ***Hebe salicornioides** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica salicornioides* Hook. f. in *Handbk. N.Z. Flora* (1864) 212.

Undoubtedly as described by Hooker, this contains more than one species, for the Nelson plant is not to be found in the mountains of either the Waimakariri or the Rangitata. Cheeseman has selected the Wairau Gorge plant collected by himself for the type. He states that this "exactly matches one of the type specimens collected by Travers in almost the same locality," though to Hooker Travers's plant was no more the "type" than those collected far further to the south, which were one or more different species, and perhaps included what is now *Hebe Armstrongii.* To his type Cheeseman has added a specimen collected by L. Cockayne near Hanmer. This differs in several particulars, and therefore the species as defined by Cheeseman is compound, consisting of at least two distinct varieties, or even species.

55. **Hebe Armstrongii** (Johnson ex J. B. Armstrg.) Ckn. et Allan comb. nov. = *Veronica Armstrongii* Johnson ex J. B. Armstrg. in *N.Z. Country Journ.* 3 (1879) 59.

The type is the plant so common in gardens, all raised vegetatively from most probably the specimen collected by J. F. Armstrong and

W. Grey (then gardener to T. H. Potts). Four months later T. Kirk in *Trans. N.Z. Inst.* 11 (1879) 464 based his *V. Armstrongii* on the same material, together with specimens collected by himself in the Upper Wairau and the "Amuri" (mountains near Hanmer?). Kirk suggested that the "plant" had the appearance of a cross between *V. salicornioides* and *V. Hectori*, but he included in the latter species not merely the Otago form or forms, but the plants from Nelson, where *H. Hectori* does not occur. Cheeseman in the *Manual* ed. 2, cites all Kirk's material, and adds a specimen collected by Petrie on the Kurow Mountains, and remarks that the species is "very rare in the wild state, but quite common in cultivation, where it varies considerably, producing leaf-sheaths much longer than any wild specimens I have seen." That is, Cheeseman includes in his conception of the species at least two different jordanons. On the other hand, we restrict the species to the Rangitata plant (*i.e.* the garden plant), but admit it to the flora, for the present, with the greatest hesitation.

56. **Hebe annulata** (Ckn.) Ckn. et Allan comb. nov. = *Veronica annulata* (Petrie) Ckn. ex Cheesem. in *Man. N.Z. Flora* ed. 2 (1925) 819.

This is a well-marked simple species related to *H. Armstrongii*, but a far smaller plant, green, not brownish, in colour, with the leaves rounded at the apex and lacking a terminal cusp. So far it is known only from one station (Takitimu Mountains, on rock at 900 m. alt.); but L. Cockayne noted several plants uniform in structure. In the *Manual* Cheeseman cites *New Zealand Plants and their Story* ed. 2, as the place of publication by L. Cockayne, but the name only is there mentioned. We have the type in cultivation.

57. ***Hebe propinqua** (Cheesem.) Ckn. et Allan comb. nov. = *Veronica propinqua* Cheesem. in *Man. N.Z. Flora* (1906) 583.

This is a distinct compound species, confined to the South Otago Botanical District, where it grows on flat, peaty ground, sometimes in large colonies. The type is the form so long cultivated in gardens under the name *Veronica salicornioides*.

(*a.*) var. *major* (Ckn.) Ckn. et Allan comb. nov. = *Veronica propinqua* Cheesem. var. *major* Ckn. ex Cheesem. in *Man. N.Z. Flora* ed. 2 (1925) 820.

This is a much larger and more robust plant than the type, and, as far as we know, much commoner than it.

58. **Hebe Poppelwellii** (Ckn.) Ckn. et Allan comb. nov. emend.

Descriptio ut in loc. cit. infra sed foliis interdum angustioribus apicibus fere acuminatis. = *Veronica Poppelwellii* Ckn. pro parte in *Trans. N.Z. Inst.* 48 (1916) 200.

The original description was drawn up from living plants growing in the gardens of Messrs. D. L. Poppelwell and J. Speden (Gore), but according to Poppelwell such matched wild plants of the Garvie Mountains. Later the senior author collected another *Hebe* on Mount Dick, which, though extremely close to the type, has still more slender shoots, and rather narrower leaves with a distinct bluntly pointed

axpex. This plant we unite with *H. Poppelwellii,* which thus becomes a compound taxonomic species. To keep separate such closely related jordanons could serve no good purpose. Evidently the group needs further study in the field.

59. ***Hebe imbricata** (Petrie) Ckn. et Allan comb. nov. = *Veronica imbricata* Petrie in *Trans. N.Z. Inst.* 48 (1916) 189.

This species was overlooked by Cheeseman in the *Manual* ed. 2. It comes close to *H. Poppelwellii,* but is a far stouter plant judging from Petrie's type. Possibly it would be best to still further extend the conception of *H. Poppelwellii* to include this species, in which case, as Petrie's description appears earlier in the volume in which both species were published, the latter name would give place to *Hebe imbricata.* This emphasizes further the need for field study of the whole group, and it is not impossible that *H. imbricata* may be really a cross between *H. Hectori* and *H. Poppelwellii.*

60. ***Hebe cupressoides** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica cupressoides* Hook. f. in *Handbk. N.Z. Flora* (1864) 212.

This is a distinct simple species, so far as is known.

[**Veronica cassinioides* H. J. Matthews ex Petrie in *Trans. N.Z. Inst.* 47 (1915) 52.]

This is based on a well-known garden plant, and on wild plants of a different origin collected by Poppelwell and Steadman on the Garvie Mountains. Both exactly match in character artificial hybrids made by crossing a *Hebe* of the whipcord type and a small-leaved *Hebe, e.g. H. buxifolia.* Hybrids of a similar form have also originated spontaneously in at least one garden. Most certainly the species as such must be removed from the flora, and the wild hybrid receive a name, while that of × *H. cassinioides* be restricted to the cultigen.

61. ***Hebe Haastii** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica Haastii* Hook. f. in *Handbk. N.Z. Flora* (1864) 213.

This is a distinct compound species of at least two jordanons.

(*a.*) var. *macrocalyx* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica macrocalyx* J. B. Armstrg. in *Trans. N.Z. Inst.* 13 (1881) 353.

This is such a well-marked jordanon that it may be best, as N. E. Brown has suggested, to treat it as a species. For its diagnosis as a variety Cheeseman uses four lines of small print.

62. ***Hebe epacridea** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica epacridea* Hook. f. in *Handbk. N.Z. Flora* (1864) 213.

This is a distinct but apparently compound species. It hybridizes with *H. Haastii,* and probably other species.

63. ***Hebe Petriei** (T. Kirk) Ckn. et Allan comb. nov. = *Veronica Petriei* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 517.

This is a most distinct, apparently simple species.

64. ***Hebe dasyphylla** (T. Kirk) Ckn. et Allan comb. nov. = *Veronica dasyphylla* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 519.

This is a distinct but compound species, remarkable, as Cheeseman states, " for the large terminal flower and 5-lobed calyx and corolla."

It was described by Hooker (*Handbk. N.Z. Flora* 1864, p. 188) as *Logania tetragona.* Hooker states that the stamens number five, but no later specimens have been found with more than two.

65. ***Hebe uniflora** (T. Kirk) Ckn. et Allan comb. nov. = *Veronica uniflora* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 522.

This is very close to *Hebe dasyphylla,* but much smaller in all its parts. Possibly it would be better to unite the two as a compound species. We have not seen it growing wild.

66. ***Hebe macrantha** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica macrantha* Hook. f. in *Handbk. N.Z. Flora* (1864) 213.

This is a very distinct compound species. Hooker based his species on specimens collected in "Middle Island, *Travers;* Southern Alps, grassy hillsides, 2500-4000 ft., sources of the Waitaki, etc., *Haast.*" This is the large-flowered variety, possibly a compound one, extending along the central Southern Alps, for which we propose the varietal name *vera.*

(*a.*) var. *vera* Ckn. et Allan var. nov. = *Veronica macrantha* Hook. f. *sens. strict.*

This occurs in wetter localities than the next variety.

(*b.*) var. *brachyphylla* (Cheesem.) Ckn. et Allan comb. nov. = *Veronica macrantha* Hook. f. var. *brachyphylla* Cheesem. in *Man. N.Z. Flora* (1906) 537.

We fully agree with Cheeseman that this is a distinct variety, distinguished from var. *vera,* as he says, in the shorter broader leaves, more numerous racemes and smaller flowers. It occurs not only in the North-western Botanical District, as given in the *Manual,* but also in the wetter part of the North-eastern District. On Mount Isabel, Hanmer, it is a characteristic member of the subalpine-scrub.

67. **Hebe Benthami** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica Benthami* Hook. f. in *Fl. Antarct.* 1 (1840) 60, tt. 39, 40.

This distinct species is confined, so far as is known, to the Lord Auckland and the Campbell Islands.

[***Veronica erecta** T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 517.]

This is a cultigen described from a plant grown in the garden of the late William Martin, nurseryman, Green Island. It is said to have been collected on Mount Bonpland, Otago, but no subsequent botanist has found there specimens to match the cultivated plant. We remove it from the flora.

68. ***Hebe Hulkeana** (F. Muell. ex Hook. f.) Ckn. et Allan comb. nov. = *Veronica Hulkeana* F. Muell. ex Hook. f. in *Handbk. N.Z. Flora* (1864) 213.

This is a very distinct compound species that contains, probably, several jordanons that require further analysis. Variously coloured flowers occur on wild plants, including white.

(*a.*) var. *oblonga* (T. Kirk) Ckn. et Allan comb. nov. = *Veronica Hulkeana* F. Muell. var. *oblonga* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 518.

Cheeseman apparently saw specimens of this, collected by three persons, so it may be a valid variety.

[*var. *fairfieldii* T. Kirk in *Trans. N.Z. Inst.* 28 (1896) 518.]

Veronica fairfieldii is supposed to be a cultigen from the late Mr. W. Martin's nursery garden at Fairfield near Dunedin. T. Kirk, however, states it came from Fairfield Downs, which, we presume, is somewhere in Marlborough.

69. **Hebe Lavaudiana** (Raoul) Ckn. et Allan comb. nov. = *Veronica Lavaudiana* Raoul in *Choix de Pl. Nouv. Zél.* (1846) 16, t. 10.

This is a distinct simple species. It is considerably plastic under cultivation.

70. ***Hebe Raoulii** (Hook. f.) Ckn. et Allan comb. nov. = *Veronica Raoulii* Hook. f. in *Handbk. N.Z. Flora* (1864) 214.

This is a distinct species, but whether simple or compound we do not know. We have noted great differences in size amongst wild plants, but this may be a matter of epharmony only.

3. Description of New Hybrids.

The hybrids here dealt with are not merely small groups of individuals standing midway in their characters between their two parents, but polymorphic swarms of individuals that usually range from forms almost identical with one or other of the parents to those standing midway in character, while the remainder may show almost all conceivable combinations of the clear-cut parental characters, or some of these characters may appear unchanged. Obviously to draw up diagnoses of such groups, as compared with diagnoses of jordanons is impossible, and only particulars of a general kind can be given in a limited space; in other words, *though taxonomic rules demand descriptions such are of no real moment.* Indeed, the need for such group-names has hardly before been properly realized, and the matter is not really provided for in the present *Rules of Botanical Nomenclature.* In view of this we have had, perforce, to make our own rules. Such hybrids as are dealt with in the *Rules* are not highly polymorphic groups of individuals, but groups of individuals of fair, or complete, constancy, usually midway between the parents. For example × *Salix capreola* is not the name of a heterogeneous group, but of a small group of closely similar individuals; and so with certain hybrids of *Primula* and other genera, for which definite diagnoses have been given.

In New Zealand taxonomy many hybrids have been described as species, and in most cases the diagnoses given apply only to a small, fairly uniform group—sometimes only to *one* plant—within the larger swarm. Obviously, to include under such a name the whole polymorphic group of which the " species " formed an insignificant part would go against the intention of the original author, and forms

absolutely distinct from the ordinary standpoint of species would come together. It has seemed to us best to give a new name to such a hybrid group as a whole—indeed, as a hybrid it has no name—, a course permitted by Articles 48, 49 of the *Rules*, for hybrids and species are certainly not of the " same rank."* On the other hand, if we use the name of the false species (and there is no law compelling us to do so) we let it stand only for the small group for which it was originally designed. In this way no confusion can occur such as would happen if the name of a definite plant or small group of closely related individuals was given an extremely wide signification. This is especially true of *Hebe*, since *any* plant may be broadcast by means of cuttings, and then remains perfectly constant, except for minor epharmonic differences.

We therefore adopt the following procedure:

(1) A name is made for the polymorphic hybrid group by combining the specific names of the two parents, in an abbreviated form, and attaching an appropriate suffix. For the most part an adjectival ending seems most appropriate, *e.g.* for the group *Hebe elliptica* × *salicifolia* we construct the name × *Hebe ellipsala.* Although we usually place the names in alphabetical order we do not hesitate to reverse them when euphony seems to demand such a course. Where a name is quite short it may be used in full, *e.g.* for the group *Hebe Astoni* × *laevis* we use × *H. laevastoni.*

(2) Should there have already been described as a species one group of the polymorphic hybrids intermediate in character between the parents that name is kept for the group of hybrid individuals coming midway between the parents. Thus Cheeseman defined a group of individuals that he considered resembled one another, as *Veronica amabilis.* This we hold is a group of hybrids coming midway between *H. elliptica* and *H. salicifolia,* and we maintain the name × *Hebe amabilis* for this small section of × *H. ellipsala,* though by the Rules we are not compelled to use " amabilis " but could give a new name.

(3) Should it seem desirable for any purpose to delimit still smaller groups within the major group, we suggest that some such formular plan as that adopted by the junior author (Allan, 1925, p. 288) is appropriate. For × *Hebe ellipsala, e.g.* the formula for the small groups would run E_5, E_4, E_3, E_2, E_1, ES, S_1, S_2, S_3, S_4, S_5. Thus × *H. ellipsala* E_5 would refer to a group very closely approximating to *H. elliptica*, and so through × *H. ellipsala* ES (a group quite midway between the parents) to × *H. ellipsala* S_5 for a group almost identical with *H. salicifolia.* Of course such formulæ should not be elaborated over much, nor should be interpretated as expressing anything more than the morphological grouping of the individuals. But it certainly seems preferable to refer to " hybrid forms

*To quote from a letter we have sent to *Nature* prior to receiving the proofs of this paper, "A hybrid swarm is a totally different biological group to that of a species. In the latter case there can be a "type," in the former a type is impossible. Further, species deal with definite static groups but hybrid swarms with indefinite dynamic groups, for the hybrids of to-day are being replaced before our eyes by other forms, yet for these the group name will serve."

of the groups S_3-S_5" than to "passage-forms into *H. salicifolia*" or "variable forms," considering the misleading nature of such phrases.

As justifying our procedure it seems clear that, as stated in the *Rules*, a name should tell of the history of the species etc., and this our method clearly does. It also tells any student of the flora who knows the specific names the exact parentage of the hybrid. The *Rules* require a name to be in Latin, but botanical Latin is by no means classical Latin, and to us it would appear to be an exceedingly hypercritical objection to raise the point that our compounded names are not in classical Latin form, and, indeed, we concede the adjectival ending merely for custom sake—we do not really think "*ellipsala*" has any advantage over "*ellipsal.*" The method seems to us so simple, practical, and informative that we are sanguine it will be generally approved and followed. Nor is it without a precedent, for there are groups of garden hybrids named in this manner, *e.g.* × *Iris monspur* = *I. Monnieri* × *spuria;* and in De Candolle's *Prodromus* the full specific names of certain species of *Cistus* are joined together to express hybridity. But to use the specific terms in full makes the name unwieldy, and so we have decided that the common-sense plan is to abbreviate them more or less.

1. × **Hebe macrosala** Ckn. et Allan hyb. nov. (*H. macrocarpa* × *salicifolia*).

Frutices altitudine habituque parentium similes; folia tenuia ut in *H. salicifolia* ad sub-crassa ut in *H. macrocarpa;* flores aliquatenus forma magnitudineque illos parentium interjacentes; capsulæ ± 5 mm. usque ad ± 8 mm. longæ.

2. × **Hebe ellipsala** Ckn. et Allan hyb. nov. (*H. elliptica* × *salicifolia*).

Frutices altitudine habituque illos parentium interjacentes; folia ± 19 mm. usque ad ± 130 mm. longa, apiculata vel sub-acuta vel sub-acuminata, tenuia vel sub-crassa, elliptica,-elliptico-oblonga, vel oblongo-lanceolata; racemi plerumque in *H. salicifolia* sed breviores quam in *H. salicifolia;* flores capsulæque aliquatenus illas parentium interjacentes.

3. × **Hebe angustisala** Ckn. et Allan hyb. nov. (*Hebe angustifolia* × *salicifolia*).

Frutices altitudine habituque parentium similes; folia plerumque plus minusve anguste linearo-oblonga vel linearo-lanceolatæ, ± 7 mm. lata usque ad ± 19 mm. lata; corollæ-tubus aliquam brevis vel longior ut in *H. angustifolia.*

4. × **Hebe laevisala** Ckn. et Allan hyb. nov. (*Hebe laevis* × *salicifolia*).

Frutices altitudine habituque illos parentium interjacentes; folia ± 12 mm. usque ad ± 100 mm. longa, ovato-oblonga, oblonga, vel lanceolato-oblonga, breviter petiolata vel fere sessilia; racemi aliquanto longiores quam in *H. laeve,* plerumque breviores quam in *H. salicifolia.*

5. × **Hebe leiosala** Ckn. et Allan hybr. nov. (*Hebe leiophylla* × *salicifolia*).

Frutices altitudine habituque parentium similes; folia plerumque plus minusve oblongo-lanceolatæ, ± 7 mm. usque ad ± 18 mm. lata; corollæ tubus aliquam brevis vel longior ut in *H. leiophylla.*

6. × **Hebe laevastoni** Ckn. et Allan hyb. nov. (*Hebe Astonii* × *laevis*).

Frutices habitu illos parentium interjacentes; folia breviora quam in *H. laeve* sed sub-erecta, non appressa ut in illis *H. Astonii;* flores fructusque adhuc non visi.

4. LIST OF LITERATURE REFERRED TO, BUT EXCLUDING SUCH AS DEALS MERELY WITH PUBLICATION OF NAMES.

ALLAN, H. H., 1925. Illustrations of Wild Hybrids in the New Zealand Flora, *Genetica,* Deel 7, pp. 287-292.

ADAMSON, R. S., 1912. On the Comparative Anatomy of the Leaves of Certain Species of Veronica, *Journ. Linn. Soc.,* vol. 40, pp. 247-274.

ARMSTRONG, J. B., 1879. Botany, *N.Z. Country Journal,* vol. 3, pp. 56-59.

—— 1880. A short Sketch of the Flora of the Province of Canterbury, *Trans. N.Z. Inst.,* vol. 12, pp. 325-353.

BAILEY, L. H., 1924. *Manual of Cultivated Plants,* p. 25. The Macmillan Company, New York.

CHEESEMAN, T. F., 1882. Contributions to a Flora of the Nelson Provincial District, *Trans. N.Z. Inst.,* vol. 14, pp. 301-329.

—— 1888. On the Flora of the Kermadec Islands, *Ibid.,* vol. 20, pp. 151-181.

—— 1897. On the Flora of the North Cape District, *Ibid.,* vol. 29, pp. 333-385.

—— 1906. *The Manual of the New Zealand Flora*—the part relating to *Veronica,* pp. 490-541.

—— 1925. *Ibid.,* ed. 2—the part relating to *Veronica,* pp. 776-827.

COCKAYNE, L., 1912. Observations concerning Evolution, derived from Ecological Studies in New Zealand, *Trans. N.Z. Inst.,* vol. 44, pp. 1-50.

—— 1916. Notes on New Zealand Floristic Botany, including Descriptions of New Species &c., *Ibid.,* vol. 48, pp. 193-202.

—— 1917. A Consideration of the Terms "Species" and "Variety" as used in Botany, with Special Reference to the Flora of New Zealand, *Ibid.,* vol. 49, pp. 66-79.

—— 1918. Notes on New Zealand Floristic Botany, including Descriptions of New Species &c. (No. 3), *Ibid.,* vol. 50, pp. 161-191.

—— 1923. Hybridism in the New Zealand Flora, *The New Phytologist,* vol. 22, pp. 105-127.

—— and ALLAN, H. H., 1925. Notes on New Zealand Floristic Botany, including Descriptions of New Species &c. (No. 4), *Trans. N.Z. Inst.,* vol. 56, pp. 21-33.

KIRK, T., 1889. *The Forest Flora of New Zealand,* Wellington.

—— 1896. Notes on Certain Veronicas, and Descriptions of New Species, *Trans. N.Z. Inst.,* vol. 28, pp. 515-531.

LOTSY, J. P., 1916. *Evolution by means of Hybridization,* Martinus Nijhoff, The Hague.

OLIVER, W. R. B., 1910. The Vegetation of the Kermadec Islands. *Trans. N.Z. Inst.,* vol. 42, pp. 118-175.

PENNELL, F. W., 1921. "Veronica" in North and South America, *Rhodora,* vol. 23, pp. 1-41.

WALL, A., 1925. *The Flora of Mount Cook,* Christchurch.

Notes on New Zealand Floristic Botany, including Descriptions of New Species, &c. (No. 5).

By L. Cockayne, Ph.D., F.R.S., and H. H. Allan, D.Sc., F.L.S.

[*Read before the Philosophical Institute of Canterbury, 2nd December, 1925; received by Editor, 31st December, 1925; issued separately, 9th October, 1926.*]

1. Taxonomic.

The taxonomic details in this paper are based upon the principles outlined by L. Cockayne in No. 3 of this series (*Trans. N.Z. Inst.* 50 (1918) 161-2) together with the conclusions reached by the same author in his paper on New Zealand hybrids (*New Phytologist* 22 (1923) 105-127), and the terms defined by us in our paper on *Hebe* in this volume are used. Though *Celmisia* is badly in need of revision from the standpoint of the "natural method" in taxonomy the genus demands most critical treatment; but we propose later to devote a special paper to the subject.

We take this opportunity of recording our most grateful thanks to the following gentlemen for assistance in various ways: Messrs. B. C. Aston, F.N.Z. Inst., F.I.C.; H. Carse; K. W. Dalrymple; W. R. B. Oliver, F.L.S., F.Z.S.; G. Simpson; J. Scott Thomson, F.C.S.; W. A. Thomson; E. Phillips Turner, F.R.G.S.; and A. W. Wastney.

67.* **Aciphylla Scott-Thomsonii** Ckn. et Allan sp. nov.

Species valde robustus, *A. Colensoi* Hook. f. affinis, a qua tenuioribus anguste linearo-lanceolatis, glaucis foliis, costis prominentibus differt.

Caulis robustus e radice crassissimo ortus, usque ad 2 m. altus, 6 cm. diam. Folia radicalia glauca, numerosa, congesta, usque ad 1 m. longa, inferne bipinnata, superne pinnata, pinnis ± 4-jugis, ± 25 cm. longis; ultima segmenta 13-25 cm. longa, usque ad 25 mm. lata, anguste linearo-lanceolata, acuminata, pungentia, marginibus haud incrassatis, serrulatis; costa supra impressa, infra sub-carinata; lamina utrinque pagina nervis numerosissimis parallelis notata, nervis transversis brevibus irregulariter despositis, distinctis; petioli et petioluli crassi, plano-convexi vel bi-convexi, supra vel infra interdum sub-carinati, basi vaginantes, serrulati. Bracteæ numerosæ, basi late vaginantes, apice pinnatæ, superne gradatim minoræ, vaginis usque ad 12 cm. longis, ± 2 cm. latis, segmentis anguste linearibus, pungentibus, striatis, marginibus serrulatis; segmentum centrale usque ad 30 cm. longum, pinnis plerumque 2-jugis multo brevioribus. Umbellæ numerosæ in paniculis magnis oblongis dispositæ. Inflorescentia ♂ in umbellis compositis disposita, peduncalis ± 12 cm. longis, bracteolis ovato-lanceolatis, ± acuminatis; umbellulæ numerosæ, satis patentes, pedicellis gracilibus; flores parvi, albi, calycis lobis acutis, antheris ± 1 mm. longis, late oblongis, filamentis gracilibus. Inflorescentia ♀ similes, umbellularum flores pauciores; fructus oblongus, ± 4 mm. longus.

*The numbers follow on consecutively in this series of papers. The previous paper appeared in vol. 56, pp. 21-33.

South Island: South Otago Botanical District—Mount Maungatua, J. Scott Thomson; Powder Hill, Mount Flagstaff, J. Scott Thomson and L. C.; Swampy Hill, G. Simpson!

This species is closely allied to *A. Colensoi,* but is distinguished by its constant glaucous colour, thinner linear-laceolata leaves, with well-marked mid-ribs. *A. Colensoi* is often epharmonically glaucous when growing in damp ground, but the glaucous hue of this species is independent of its growing-place. We are indebted to Messrs. Thomson and Simpson for living material and field notes. The description has been drawn up from material from Mount Maungatua.

68. **Anisotome Enysii** (T. Kirk) R. M. Laing var. **tennysonianum** R. M. Laing.

Laing gave specimens of this to the herbarium of the Museum of Canterbury College. These exactly match *Angelica trifoliolata* (Hook. f.) Ckn., a fact first pointed out to the senior author by Professor A. Wall. The variety, then, must be removed from the flora. Up to Laing's discovery of the above species at Lake Tennyson (North-western Botanical District, at its junction with the North-eastern Botanical District) it was only known from Mount Torlesse, where it grows in sphagnum bogs. In any case, it appears to be a very rare species.

69. **Cassinia** hybrids.

While this paper is being revised prior to sending it for publication a series of specimens of *Cassinia* collected by Mr. George Simpson on Mount Maungatua have reached us. So interesting are they that a brief preliminary note seems necessary. Out of many plants differing from one another ("a tremendous mixture" according to Simpson's letter) we have received thirteen. Of these there is one we refer to *C. albida* (T. Kirk) Ckn.—a species previously unrecorded south of the extreme north of the Eastern Botanical District—, and another to typical *C. Vauvilliersii* Hook. f. The remainder we consider either hybrids between the above, or, as Simpson suggests, with *C. fulvida* also playing a part. No two plants are alike, the fundamental differences being size and shape of leaves, colour of tomentum —white to fulvous, with all intermediates—, and degree of greenness of the upper surface of the leaf. We defer giving a name to the group until further details are available; *e.g.,* is the plant we refer to *C. albida* identical with the type? One interesting point stands out clearly, namely that *C. fulvida* var. *linearis* T. Kirk (*Students' Flora* (1899) 316—"leaves . . . distant . . . very narrow . . . clothed with *white* tomentum beneath"—italics ours), which was collected by Aston near Dunedin, and later by H. J. Matthews, is certainly one of this hybrid group. Cheeseman's remarks (*Manual* ed. 2 (1925) 986) that "the species [of *Cassinia*] are very closely allied, and are by no means easy to discriminate" are readily explained by the fact of there being swarms of hybrids; but we would say that the species themselves are quite distinct, their only polymorphy being that of slight fluctuating "variability," or in some cases the presence of more than one jordanon. Information such as that supplied by Mr. Simpson is, in our opinion, far more valuable than the discovery of a new species.

70. **Clematis australis** T. Kirk.

The original place of publication of this species was not, as always cited, *The Students' Flora* (1899) 3, but a sample page of what that work would be, published in 1891 at the time of the third meeting of the Australasian Association for the Advancement of Science. This description was widely circulated and was certainly " effective publication " according to the *Rules of Botanical Nomenclature*. Unfortunately we are not now in possession of a copy of the above publication and cannot give the actual citation.

By Kirk, followed by Cheeseman in both editions of the *Manual*, the flowers are described as *white*, and this is used as a distinctive mark putting the species in the same group as *C. indivisa* and *C. hexasepala;* but, in point of fact, the flowers are invariably *yellow*.

71. **Clematis Colensoi** Hook. f.

The plant of the Eastern Botanical District (*Manual* ed. 2 (1925) 431) referred to *C. Colensoi* can only be accepted with considerable hesitation, especially in the light of the statement that *C. Colensoi* is " a variable plant not always readily distinguishable from states of *C. hexasepala* and *C. australis* "—a statement which implies that its author did not know the true limits of these species. Petrie, in a letter to the senior author, was at one time inclined to separate the plant in question and a similar form from the North-eastern District as a new species. It is well that he refrained, as he had only a few dried plants for his material; but it is necessary that these eastern South Island forms of *Clematis* be examined carefully in the field.

72. **Corallospartium racemosum** (T. Kirk) Ckn. et Allan sp. nov. = *C. crassicaule* (Hook. f.) J. B. Armstg. var. *racemosum* T. Kirk in *The Students' Flora* (1899) 107.*

A fairly long description of this species is given by Kirk (*loc. cit.*) so that but little need be added here. The species is at once separated from *C. crassicaule* by its stems—less stout, almost flat, green (not yellow), more finely grooved; and by the flowers—in few-flowered racemes, the flowers with a deep purple blotch at base of standard, from which radiate light-purple lines to the margin, the wings with light purple lines but not fully covered with such, the keel with a purple blotch, and the calyx-teeth touched with purple—(information re colour supplied by J. S. Thomson).

South Island: (1) North Otago Botanical District—near Lindis Pass, J. Buchanan ex Kirk. (2) South Otago Botanical District—Mount Roy (near Lake Wanaka), L.C.; Ben Lomond, on shady rocks, J. S. Thomson!, L.C.; Mount Dick, G. Simpson and J. S. Thomson! The Hector Mountains plant cited by Cheeseman as collected by W. Willcox most probably comes here.

The species is evidently wide-spread, but local, in the South Otago District, and, unlike *C. crassicaule*, grows under fairly moist conditions.

*No actual date of publication is given for *The Students' Flora*, so we take that of the preface.

73. Coriaria lurida T. Kirk.

Kirk (*The Students' Flora* (1899) 98) separated his *C. lurida* from the group hitherto known as *C. thymifolia*, giving as its distinctive features "its lurid hue and strict habit, but presenting no structural points of difference." Oliver (*Trans. N.Z. Inst.* 53 (1921) 364) enlarges the conception of *C. lurida* to include all the New Zealand forms up till then referred to *C. thymifolia*, stating "This New Zealand species, hitherto referred to *C. thymifolia* can easily be distinguished from all the American forms by the habit and shape of the leaves. *C. thymifolia* occurs from Mexico to Peru, and is a quite distinct species with small closely-set ovate acute leaves, which, though varying in size, are nearly constant in shape."

We consider the group to be a linneon, composed of several distinct jordanons, which hybridize when in company. A jordanon known to us from the bed of the Ashburton River answers quite well the brief description of *C. thymifolia* given by Oliver, as cited above. But Mr. Oliver, after examining specimens, has kindly informed us that it is distinct from the true *C. thymifolia* and has smaller leaves. Possibly Kirk's *C. lurida* is also a jordanon, but we are insufficiently acquainted with it at present to decide. In the meantime we follow Oliver in using *C. lurida* for the name of the compound species.

The species of *Coriaria* hybridize most freely when they meet, and produce polymorphic groups, some forms of which are barely distinguishable from one or other of the parents, others come about midway between, and others again link up the whole swarm into a completely intergrading series. In all probability the North Island plants referred by Cheeseman (*Manual ed.* 2 (1925) 547) to *C. angustissima* belong to the group *C. lurida* × *sarmentosa*, and we unhesitatingly refer the so-called *C. angustissima* of Mount Egmont to that group, for which we propose the following name:

× *Coriaria sarlurida* Ckn. et Allan.

Plantae parentium signa diverse interligentes. Habitus sub-herbaceus vel suffruticosus. Folia inflorescentiaeque individuorum illas parentium interjacentes.

We give this description, such as it is, perforce, since the present *Rules* demand one, but obviously nothing but a detailed analysis of the forms can give any satisfactory information as regards any hybrid swarm. Such group-names as we propose have hardly before been contemplated for wild hybrids, but we consider them of great convenience and importance, telling as they do at a glance the parentage involved, whereas an arbitrary name, after some collector, or what not, tells nothing of value. It is greatly to be hoped that when an International Conference is again held, some simple, commonsense rule for the making valid of such group-names will be drawn up.

We also take out from the compound species the following varieties:

(*a.*) *Coriaria lurida* T. Kirk var. *parvifolia* Ckn. et Allan var. nov.

Planta humilis, sub-herbacea; rhizomata late vagantia; caules usque ad 1 dm. longi; folia ovata, acuta, vel sub-acuminata, plerumque ± 5 mm. longa, ± 2 mm. lata; racemi graciles ± 5cm. longi; flores parvi.

North Island: *Egmont-Wanganui Botanical District*—*Mount Egmont*, at c. 1200 m., on scoria-slopes, and in tussock-grassland: H.H.A.

(*b*.) *Coriaria lurida* T. Kirk var. *acuminata* Ckn. et Allan var. nov.

Suffrutex; rhizomata aliquanto condensata, caules usque ad 2 dm. gi; folia anguste ovato-lanceolata, valde acuminata, plerumque ± 25 mm. longa, ± 5 mm. lata; racemi et flori paulo majores.

North Island: Egmont-Wanganui Botanical District—Mount Egmont, at c. 1150 m., subalpine shrubland, margins of streams in subalpine forest and scrub: H.H.A.

These distinct jordanons have, on Mount Egmont, their own characteristic habitats, but where they meet hybrids are abundantly produced. Both probably have a fairly wide distribution, but in the absence of definite information we cite only the locality from which the type specimens were described. The Ashburton plant abovementioned closely resembles var. *parvifolia*, and probably should be placed with it, while we have seen very similar specimens from Lochy River (near Lake Wakatipu) collected by Messrs. J. S. Thomson and G. Simpson.

74. **Cotula Dendyi** Ckn. in *Trans. N.Z. Inst.* 47 (1915) 118.

This is rightly reduced by Cheeseman (*Manual ed.* 2 (1925), 993) to a variety of *Cotula atrata* Hook. f., but Cockayne is incorrectly cited as the author responsible for the change—for instance, in *The Vegetation of New Zealand*, (1921) 228, 344, the species is upheld by its author. Though the species was first published in 1915 the name had been in use for a good many years. The flowers, as given in the description, "vary from quite pale yellow to brown," and we strongly support L. Cockayne's original suggestion, made in 1915, that plants with flowers other than yellow belong to *C. atrata* × var. *Dendyi*, for the species and its variety frequently occur in close proximity. *Cotula atrata* is thus increased in its content, and becomes a compound species made up of var. *Dendyi* Ckn. ex Cheesem. (but excluding the dark-flowered hybrids), and the type, for which we propose the name var. *typica* Ckn. et Allan var. nov., and which is identical with *C. atrata* Hook. f. in *Handbk. N.Z. Flora* (1864) 142.

75. **Cotula sericea** (T. Kirk) Ckn. et Allan sp. nov. = *C. pectinata* Hook. f. var. *sericea* T. Kirk in *The Students' Flora* (1899) 326.

This species is readily distinguished from *C. pectinata* by its smaller dimensions, including the head only about 8 mm. diam., and the covering of dense silky hairs of nearly every part. It crosses with *C. pectinata*, and we have seen many "intermediates" of this class.

South Island: probably on all the higher mountains of the South Otago Botanical District.

76. **Danthonia setifolia** (Hook. f.) Ckn.

Hooker's variety *setifolia* of *D. semiannularis* R. Br. was created a species by L. C. in *N.Z. Journ. of Agric.* 23 (1921) 146 footnote. This change has not been cited by Cheeseman in the *Manual ed.* 2, but the species is most distinct, occurring unchanged throughout most of mountainous New Zealand. It is in fact far more distinct from

D. semiannularis than is that species from *D. pilosa.* As it is a somewhat important agricultural grass of the mountain sheep-runs it is desirable the name should receive recognition.

77. **Discaria toumatou** Raoul.

The discovery of a semi-spineless form of the above (L. Cockayne, *N.Z. Journ. of Sc. and Tech.* 5 (1922) 206-8), which is a matter of distinct biological moment, is not mentioned in the *Manual ed.* 2. The shrub grows alongside the ordinary spinous form in identically the same habitat. It is of drooping habit; some of the twigs are spineless, while on others there are spines more or less stunted or up to 18 mm. long. The senior author has a vigorous plant grown from a cutting of the wild plant in his garden at Wellington that still possesses the same characters.

South Island: Fiord Botanical District—Valley of the Dart near Kinloch, L. C., J. S. Thomson and G. Simpson (who have sent us fresh seed for genetic experiments).

78. **Fuchsia perscandens** Ckn. et Allan sp. nov. (Fig. 1).

Caules scandentes, graciles, cortice pallide brunneo, tenui sed non chartaces, obtecti, parce ramosi, ramis divergentibus; ramuli hornotini gracillimi, pubescentes, nebulosi; ramuli annotini minute sulcati. Folia satis distantes, late ovata vel sub-orbiculata, sub-acuta, marginibus sinuatis, remote obtuseque dentati; tenuia, decidua, primo parce pubescentia, supra pallide viridia, infra glaucescentia, nervis reticulatis evidentis, primo ciliatis; petioli plerumque ± 2 cm. longi, graciles, nonnunquam multo longiores, laminis plerumque ± 3 cm. longi, ± 2 cm. lati. Flores solitarii, vel rarius 2-3 in axillis foliorum aggregati, penduli, pedunculis gracillimis ± 1 cm. longis; calycis tubus ± 9 mm. longus, basi inflatus, deinde abrupte angustatus, superne hypocrateriformis; calycis lobi ± 7 mm. longi, anguste ovati, acuminati, patentes; petala atro-purpurea, anguste oblonga, ± 2.5 mm. longa; stamina 8, filamentis purpureis ± 5 mm. longis; stylus gracilis, capitatus, ± 12 mm. longus, interdum longior; bacca atropurpurea, sub-cylindrica lateribus obscure tetragoniis, ± 1 cm. longa, ± 5 mm. diam.

(*a.*) North Island: Ruahine-Cook Botanical District — forests near Feilding, abundant, H.H.A.

(*b.*) South Island: (1) Sounds-Nelson Botanical District—E. C. Jeffrey and L.C.; (2) North-western Botanical District—near Murchison, H.H.A.; (3) Eastern Botanical District—Malvern Hills, L. C. —said by G. Simpson and J. S. Thomson to be absent near Dunedin, and by J. Crosby-Smith to be unknown in Southland.

Fuchsia Colensoi Hook. f. was very briefly described in the *Handbk. N.Z. Flora* (1867) 728 as "intermediate in size [between *F. excorticata* and *F. procumbens*]. Leaves very variable, ovate orbicular or cordate. Flowers as large as in *F. excorticata*—Northern Island, *Colenso.* Middle Island, common, Canterbury Plains, *Travers;* Otago, *Lindsay, Hector.*" T. Kirk's description in *The Students' Flora* (1899) 181 includes the statement "A small erect or prostrate shrub with slender branchlets." Cheeseman in *Manual* ed. 1 (1906) 187, describes the species as "A small shrub with long straggling

branches, sometimes producing slender flexuous unbranched shoots several feet in length," and adds " a very variable plant, large forms of which almost pass into *F. excorticata."* In the *Manual* ed. 2 (1925) 618 his original description is repeated, and the statement made, " This is either a very variable plant, or two very distinct forms are included in the present conception of the species."

Our opinion, based on field observations, so strongly supports Cheeseman's supposition of there being two distinct species included in Hooker's species that we restrict *Fuchsia Colensoi* Hook. f. to some jordanon or group of such, of shrubby habit, and define the true liane, which evidently is absent in many localities, as the new species *F. perscandens*—the name indicating a far more lianoid form than is seen in *F. Colensoi,* which according to Hooker and

Fig. 1. *Photo.: H. H. Allan.*
In foreground the lianoid stems of *Fuchsia perscandens* Ckn. et Allan, which have fallen from their original support; Kitchener Park near Feilding.

Cheeseman is a linneon. The linneon includes at the ends of the series *F. excorticata* and *F. perscandens,* while the problematical *F. Colensoi* comes more or less mid-way between the two, and all are connected by an almost bewildering group of hybrids, the parentage of which it is impossible to define unless one or other of the parents is far-distant from the locality where they occur.

The photograph (Fig. 1) shows the cable-like stems of the liane. When growing in the open this species forms tangled rounded masses, similar to those formed by species of *Rubi* under similar conditions. Such rounded masses are easily distinguished from the hybrid forms by the absence of a stout branching, erect base. The description was drawn up from living plants growing in Kitchener Park, Feilding.

79. Gentiana serotina Ckn.

In the *Manual* ed. 2, both in the body of that work and in the index, the specific name is written *" scrotina."* By Cheeseman the

species was regarded as "a reduced state of *G. corymbifera*," but as it grows in practically the same habitat as that species it is impossible to guess how such "reduction" could come about. To us it is one of the most distinct gentians in the flora. The species consists of two jordanons, the one with the corolla-lobes close together and the other with them further apart, the flower of the latter having a somewhat starry appearance. These forms can be readily observed in the field, and one or the other be gathered for certainty.

80. **Helichrysum Purdiei** Petrie.

This is described by Cheeseman as a "very puzzling species not very closely allied to any other." How it could be so designated, and not considered "a well-marked species," as it was free from the troublesome "intermediates," we do not know, but suspect that Cheeseman had more than a suspicion of its hybrid origin, since he speaks of the Hanmer specimens as growing "in company with *H. bellidioides* and *H. glomeratum*." The truth is that, so far, wherever it has been found—Clarence Valley, Aston., to Arrowtown, L. C.—the above two species are always in the neighbourhood. The inflorescence is far from uniform in structure as defined in the *Manual*, and many distinct plants differing in various characteristics can be seen where the hybrid is in quantity, as near Hanmer. To Mr. C. E. Christensen is due the credit of first bringing proof that *H. bellidioides* and *H. glomeratum* crossed. The cross is the more interesting since it is between different sections of the genus—*Xerochlaena* and *Ozothamnus*. We do not propose a name and define such for the group at present since our material is not sufficient for a proper analysis, but the formula of course will be *Helichrysum bellidioides* × *glomeratum*.

81. **Helichrysum Selago** (Hook. f.) Benth. et Hook. f. var. **tuberculata** Cheesem.

This, as collected by L. Cockayne, includes one of the plants upon which the variety is based. But it grew side by side with *H. coralloides* and *H. Selago*, and coming as an intermediate between the two is doubtless one of their hybrids.

82. **Hoheria populnea** A. Cunn.

Cheeseman states (*Manual* ed. 2 (1925) 564) that *H. populnea* passes through a juvenile stage "markedly different to the adult," and he bases this statement not on observations from the living plant during its development, but on specimens given to him by Mr. Carse. On the other hand, we are well acquainted with the life-history of the species in question, and can state without fear of contradiction that it is virtually the same in the juvenile as in the adult, and that it never possesses a juvenile divaricating form, as does *H. angustifolia*, or a twiggy, more or less weeping form like that of *H. sexstylosa*. There are certainly in the juvenile a few reduced leaves here and there, but mixed with far more leaves of the adult type. Further, we are greatly indebted to Mr. H. Carse for sending us a collection of specimens similar to those on which Cheeseman based his opinions, but they show only a small degree of leaf-reduction, and give no

idea of the growth-form. We have gone into this matter at some length for the different behaviour as a juvenile of *H. populnea* from that of its allies is of great importance from the standpoint of evolution. Our observations include the study of seedlings in gardens up to their reaching maturity, as well as field observations.

83. **Lepidium tenuicaule** T. Kirk.

In *Trans. N.Z. Inst.* 14 (1882) 381 Kirk described his *Lepidium tenuicaule* and *L. australe*, from plants collected at Cape Wanbrow, Oamaru. In *The Students' Flora* (1899) 38 he reduced the latter to a variety of the former. Cheeseman in both editions of the *Manual* has treated *L. australe* as an epharmone of *L. tenuicaule*. After a study in the field of the Cape Wanbrow plants we consider this treatment to be correct. Robust forms growing through grass often develop more cauline leaves and are caused to assume a more erect habit of growth.

In *Trans. N.Z. Inst.* 43 (1911) 175 Cheeseman created a variety *minor* for plants collected at Titahi Bay. This variety is retained in the *Manual* ed. 2 (1925) 473, where the statement is made "Both the type and var. *minor* on Kapiti Island, off Cook Strait." An examination of the plants on Kapiti Island, and at Titahi Bay (where the type also occurs) led us to suspect that var. *minor* was also an epharmone, due to its special habitat conditions. To test this, plants of the different forms were collected and grown inland. These have become indistinguishable from one another, and accordingly we regard var. *minor* as an epharmone merely, and as a taxonomic variety it should be abandoned.

The species occurs coastally at Timaru and Ashburton in addition to the localities cited in the *Manual*. In both these places it has been carried inland by gravel used for road—and railway—metal, as we have actually witnessed occurring at Oamaru. Probably most or all of the inland localities recorded are due to such carriage.

84. **Libertia peregrinans** Ckn. et Allan sp. nov.

Species *L. ixioides* (Forst. f.) Spreng. affinis, sed rhizomatis late vagantibus facile distinguitur.

Rhizoma horizontale, crassum, usque ad 8 mm. diam. Folia plura, ad nodos rhizomatorum conferta, angustissime linearia, apice attenuata, rigide crassa, usque ad 70 cm. longa, sub-nitentia, basi vaginantes, marginibus nonnunquam tenuiter scabridiusculis exceptis glabra; nervis lateralibus utrinque circiter 4, pagina utraque distincti, costis prominentibus subcomplanatis. Inflorescentia paniculata ramis alternatis, ramulis ultimis subumbellatis, pedicellis gracilibus; bracteae inferiorae usque ad 10 cm. longae, anguste linearo-lanceolatae, acuminatae, conduplicatae, superiorae gradatim minorae, chartaceae; tepala 3 exteriora patentia, supra albida, infra margine excepto cervina, ± 8 mm. longa, elliptico-oblonga, obtusa; tepala 3 interiora candida, ± 11 mm. longa, ± 9 mm. lata, late elliptico-oblonga, retusa, in unguem brevem abrupte angustata; stamina 3, filamentis erectis, basim versus connatis, usque ad 6 mm. longis, antheris oblongis versatilibus, ± 3 mm. longis; styli 3-ramosi, ± 5 mm. longi, sub-patentes; capsula matura ± 1 cm. longa, oblongo-obovoidea.

Northern, Central, and Southern Botanical Provinces; Chatham Islands: forming extensive colonies in sand-hollows.

The description is drawn up from plants collected in sand-hollows near Foxton (Ruahine-Cook Botanical District). Hitherto this species has been referred to *L. ixioides*, but it is at once distinguished by the far-spreading rhizomes, emitting dense tufts of leaves at intervals. It is confined to sand-hollows, and when growing wild is of a more or less bronze colouring in all the vegetative parts, but in cultivation inland the colour becomes distinctly more green. As a garden plant its stoloniferous habit makes it too aggressive for small gardens, or for alpine gardens, but where there is plenty of room it is well worth cultivating.

85. **Macropiper excelsum** (Forst. f.) Miq. var. **major** Cheesem. in *Manual, N.Z. Flora* ed. 1 (1906), 595.

In the *Manual* ed. 2, Cheeseman follows R. M. Laing in changing the name *major* to *psittacorum*. Laing, however, was wrong in making the change, for though *Piper psittacorum* is a synonym for var. *major*, there is no obligation on the part of an author to follow the general rule of priority when transferring a species to a subdivision of such (See Art. 49, p. 47, *Internat. Rules of Bot. Nomencl.*), though he is rightly recommended to do so. But when transferring var. *major* of *Piper excelsum* to a var. of *Macropiper excelsum*, the original varietal name—*major*—must stand, it cannot be altered to *psittacorum* without ignoring Art. 48 *loc. cit.*, therefore the valid name is *Macropiper excelsum* var. *major* as above.

86. **Mida** A. Cunn.

This genus was published by Allan Cunningham in the *Annals of Natural History* 1 (1838) 376. He distinguished three species as follows: (1) *M. salicifolia*, foliis angusto-lanceolatis acuminatis, (2) *M. eucalyptoides*, foliis lanceolatis acuminatis, (3) *M. myrtifolia*, foliis ovalibus ovato-lanceolatis obtusiusculis acuminatisve. We consider Cunningham's genus amply distinct from *Fusanus* R. Br., under which it was treated as a section by Bentham and Hooker in *Genera Plantarum*, and accordingly restore it. Moreover, we accept *Mida salicifolia* and *M. myrtifolia* as valid species (*M. eucalyptoides* being perhaps a hybrid between these), as against W. Hooker's merging them into one in *Icones Plantarum*—a treatment followed by subsequent botanists, including Cheeseman. The species hybridize where they meet, and produce "intermediates." Where only one species is present, as in the Ruahine-Cook District, it is constant, though each has its distinct juvenile form. Were the merging accepted in this case, it should logically be followed in other hybridizing groups, *e.g.* the species of *Parsonsia*.

87. **Olearia Cheesemanii** Ckn. et Allan sp. nov. = *O. arborescens* (Forst. f.) Ckn. et Laing var. *angustifolia* Cheesem. in *Manual N.Z. Flora* ed. 1 (1906) 285.

As we reject all merging of extremely distinct true-breeding groups upon the unproved and highly improbable theory that they "vary" and "run into one another," so must we separate the linneon *O. arborescens* into those simple or compound species, hybrids

and epharmones which form its content as defined in the *Manual* ed. 2. First of all comes out *O. capillaris* Buch., and its hybrids. Then probably var. *cordatifolia* is simply a series of hygrophytic epharmones, and it must be removed from the flora. Finally there is the very distinct var. *angustifolia* Cheesem., which is undoubtedly a valid species distinguished from the two other species by its thin lanceolate leaves with sinuate margins, lax, much-branched corymbs, but smaller than those of *O. arborescens* but much larger than those of *O. capillaris.* Another proof of its validity as a species is the record by Cheeseman in *Trans. N.Z. Inst.* 46 (1914) 4, of " a form almost intermediate between var. *angustifolia* and the type " Where the species occurs by itself, as in the Otaki Gorge, there are no " intermediates " *i.e.* no hybrids.

So far *Olearia Cheesemanii* has been recorded from Ohinemuri Gorge, Lake Waikaremoana, Ngakawau near Westport, and K. W. Dalrymple and H. H. A. have recently found it in quantity in the Otaki Gorge, absolutely constant in form, growing on rock in the shade of *Carmichaelia odorata* and *Hebe salicifolia* var. *angustissima.* As a garden plant it would be of high excellence, and it will probably be hardy in many parts of Great Britain and Ireland.

88. **Ranunculus Simpsonii** Ckn. et Allan sp. nov.

Herba *R. sericophyllii* Hook. f. affinis, foliis glabris, sub-carnosis, bracteis sub-foliaceis, achaeniis minute pubescentibus, stylis gracilioribus differt.

Rhizomata crassa, ramosa, ramis ascendentibus. Folia radicalia in rosellas ad apices rhizomatorum ramorum conferta; petioli usque ad 10 cm. longi, plerumque breviores, sparsis gracilibus patentibus pilis induti, supra 1- sulcati, sulcis hirsutis, virides, late vaginantes; laminae ± 2 cm. longae, ± 2.5 cm. latae, 3-5- partitae fere ad basim, latissime ovatae, petiolulis inferne sulcatis, lobis tripinnatisectis, ultimis segmentis linearibus vel lanceolato-oblongis, subacutis vel obtusis, paulo carnosis, glabris, vel primo parcissime pilosis, venis distinctis supra satis impressis. Scapi uniflori vel 2-flori, usque ad 8 cm. longi, satis crassi, ± 3 mm. diam., pilis gracilibus sub-patentibus, obtecti. Bracteae inferiorae foliis sub-similes, petiolatae; superiorae laminis 1-5 partitis, segmentis oblongis, obtusis, petiolis ± 1 cm. longis, supra glabris, infra pilis longis indutis. Sepala 5, pallide viride flava, obovato-oblonga, retusa vel 2-crenata, concava, ± 12 mm. longa, ± 6 mm. lata, infra sparsis pilis basi versus induta. Petala plerumque 5, late obovata vel oblongo-obovata, cuneata, sinuato-obtusa, in ungues breves angustata, ± 1.5 cm. longa, ± 1 cm. lata. Nectaria 3, depressa, apice unguis posita. Stamina numerosae, filamentis ± 6 mm. longis, antheris oblongis ± 1.5 mm. longis. Achaenia matura numerosissima in capitula subglobosa ± 1 cm. diam. aggregata, paulo turgida, minute pubescentia, ± 2 mm. longa, leviter carinata, in styla ± 2 mm. longa, satis gracilia, parum torta, angustata, ambitu dimidiato-turbinata.

South Island: South Otago Botanical District—Bold Peak (near Lake Wakatipu) c. 1800 m., abundant, G. Simpson and J. Scott Thomson!

This handsome little species is allied to *R. sericophyllus* Hook. f., but is amply distinct, and is at once separated by its glabrous leaves. According to the discoverers it favours finely disintegrated rock as its habitat. It will make a good addition to the rock-garden *Ranunculi*. The description has been drawn up from living plants and from spirit-preserved material sent by J. Scott Thomson.

89. **Rubus cissoides** A. Cunn. var. **subpauperatus** Ckn.

Cheeseman (*Manual* ed. 2 (1925) 500), cites Cockayne as the author of the above variety, which it is stated Cockayne published in his *Report on a Botanical Survey of Stewart Island*. This is not correct;—what was published in that report was a species—certainly valid—named *Rubus subpauperatus*, which is only in part the var. *subpauperatus* of the *Manual*. Cheeseman further states that the variety produces flowers in the shade, implying that it does not do so when growing in the open. On the contrary, *R. subpauperatus* flowers freely when growing in full sunshine in contradistinction to *R. cissoides* var. *pauperatus*—an epharmone, not a jordanon and so as a variety should be removed from the flora—which rarely, if ever, blooms except in the shade. Finally *R. subpauperatus* Ckn. is absolutely distinct from any form of *R. cissoides*, and comes much closer to *R. schmidelioides* var. *coloratus;* in fact this group of plants might be joined to *R. subpauperatus*, thus making the latter a compound species.

90. **Senecio rotundifolius** Hook. f. var. **ambiguus** Cheesem.

This variety was designed by Cheeseman to include the forms of shrubby *Senecio* growing on the west coast of the North-western Botanical District concerning which there has been great difference of opinion. The matter was gone into at considerable length by L. Cockayne (*Trans. N.Z. Inst.* 50 (1918) 183-4) who, however, had only a living specimen not in flower, collected by Mr. B. C. Aston at West Wanganui Inlet. The conclusion reached was that the taxonomic position of the plant in question was "quite uncertain," that it was neither typical *S. rotundifolius* nor typical *S. elaeagnifolius*, but that it might be a variety of either, or a distinct, undescribed species. Cheeseman (*Manual* ed. 2 (1925) 1026) virtually follows Cockayne in founding the var. *ambiguus*. On the other hand, he and T. Kirk had earlier referred the group to typical *S. rotundifolius*, while Petrie (*Trans. N.Z. Inst.* 46 (1914) 30) had "without hesitation" referred the Cape Foulwind plant to *S. elaeagnifolius*. Upon examining the specimens in Petrie's herbarium we found they were by no means uniform, some resembling *S. rotundifolius*, some *S. elaeagnifolius*, and some more or less intermediate. Probably both species are present on the coast, and var. *ambiguus* is a hybrid between them, but we hope, later, to go fully into the question.

91. **Teucridium parvifoliun** Hook. f. var. **luxurians** Cheesem.

This variety, described in the *Manual* ed. 2 (1925) 764, was based by Cheeseman on specimens collected from a *single* plant growing in forest shade on the banks of the Mangles River (North-western Botanical District). We have since studied the species as it grows in forests between Pohangina and Feilding (Ruahine-Cook Botanical

District). There it is abundant, and agrees exactly with Cheeseman's variety. A point not referred to by him, but quite marked in the original specimens, is that the leaves are frequently irregularly lobed. The corolla is invariably white. The production of 2-3 flowered cymes differs considerably in the individual plants, many being almost entirely with solitary flowers, many again with a majority of flowers in cymes. Moreover, an examination of individual plants has shown that the degree of production of cymose inflorescences may vary from season to season.

At first sight the variety appears abundantly distinct from the very small-leaved form, but in this latter there is also an occasional development of cymose inflorescences, and it is desirable that further field study should be made to decide whether the variety is valid, or is a shade-epharmone. The plant in the localities here cited is plastic, getting smaller-leaved in the more open situations, and becoming a semi-liane in the denser shade.

92. **Trisetum saxeticolum** Ckn. et Allan sp. nov.

Gramen perenne, caespitosum, ad 2 dm. altum, *T. subspicati* Beauv. affinis sed habitu rubustiore, culmis glabrescentibus distinguitur.

Culmi erecti vel sub-geniculati in rhizomate brevi oblique arti conferti, ± 15 mm. longi, paulo incrassati, 2- vel 3-nodi, nodis plerumque in foliorum vaginis inclusis, teretes, glabrescentes, sulcati, sulcis minute pubescentibus. Foliorum vaginae striatae, sub-chartaceae, minute pubescentes, basales ± 2 cm. longae, persistentes, pallidae; ligulae breves, ± 1 mm. longae, laceratae; laminae lineares, ± 9 cm. longae, erectae, planae vel conduplicatae, in acumen filiforme attenuata, molliter pubescentes. Panicula angusta, spiciformia, multiflora, ± 4 cm. longa; axis primarius leviter pilosus; rami graciles, erecti, leviter scabridiusculi; spiculae 2-3 florae, ± 6 mm. longae, arista excepta, in maturitate straminellae, sub-nitentia; gluma inferior ± 4 mm. longa, uninervia, acuminata, molliter pubescens, marginibus scariosis, carina scabrida; gluma superior similiter, ± 5 mm. longa, fere aristata, 3-nervia; rhachilla pilis albis longis gracilibus ornata; valva paulo incrassata, pubescens, ± 5 mm. longa, carinis scaberulis, bifida; arista ± 6 mm. longa, erecta vel aliquanto inclinata, minute scaberula; palea scariosa tenuiter bicarinata, apice bifida, carinis minute ciliatis; caryopsis ± 3 mm. longa, fusiformia.

North Island: Ruahine-Cook Botanical District—in crevices of coastal rocks, northern shores of Cook Strait.

The occurrence of this species on coastal rocks near Wellington has long been known; but if dealt with at all, it has previously been referred to *T. subspicatum* Beauv. It is certainly related to that species, but differs, among other things, in the robuster habit, the finer pubescence (*T. subspicatum* is rather tomentose than pubescent), the practically glabrous culms, much larger panicles, with the rhachillas pilose, and the glumes hardly shining. The type specimens were gathered by H. H. A. on rocks near Island Bay, Wellington. The species probably has a wider distribution than is at present known.

Buchanan in *Trans. N.Z. Inst.* 6 (1874) 226, includes *T. subspicatum* in his list of the species occurring in the Wellington Province,

but gives no localities. Aston in *Trans. N.Z. Inst.* 43 (1911) 247 also includes in his list of plants of the Wellington Province "*T. subspicatum* Beauv. ascends to 5,000 ft." We are not acquainted with any localities for *T. subspicatum* in North Island, nor does Cheeseman in either edition of the *Manual* cite any North Island localities. *T. subspicatum* is, of course, a compound species, but it would seem most probable that in part at least both Aston's and Buchanan's gatherings are attributable to *T. saxeticolum*.

2. EXOTIC SPECIES WRONGLY INCLUDED IN THE FLORA.

We give here a list of exotic species that should be excluded, in whole or in part, from the flora, but which are accepted in the *Manual* ed. 2, together with species as to the origin of which there is grave doubt. Cheeseman in the *Manual* ed. 2 (1925) 532, makes the following statement under his description of *Geranium molle*: "There can be little doubt that this is introduced, but as it has had a place given to it in previous works on New Zealand plants, and as it is now found in all soils and situations, and would certainly be considered indigenous by a stranger unacquainted with its history, it appears best to retain it in the Flora." None of these arguments seem to us to have any cogency whatever—it does not seem well to repeat the mistakes of the past, the description of this particular plant's habitats is altogether too sweeping, and were the last reason valid then exotic species after species would have to be admitted. That it is desirable that a flora of the exotic species occurring in New Zealand should be prepared we do not gainsay, but in view of the important principles involved, not least from the phytogeographic standpoint, and the misinterpretations likely to be made were Cheeseman's procedure followed, we strongly deprecate any such admissions to floras explicitly claiming to deal with the indigenous plants of a country. It is indeed fortunate as far as the New Zealand flora is concerned that there are so few really doubtful cases. With the flora of such a country as Great Britain, of course, the matter is in quite other condition.

1. **Ageratum conyzoides** L.—This was recorded by Cheeseman in *Trans. N.Z. Inst.*, 20 (1888) 169 for the Kermadec Islands. He remarks "Perhaps introduced, but it is truly native in many parts of Polynesia." Oliver, rightly we think, placed it in his list of introduced species in *Trans. N.Z. Inst.* 42 (1910) 174.

2. **Aleurites moluccana** Willd.—This was also recorded by Cheeseman (*loc. cit.*, p. 172). Oliver (*loc. cit.*, p. 174) in treating of it as an introduced species says "The candle-nut (*Aleurites moluccana*), like the Polynesian ti, appears to be the survivor of the abandoned cultivations of the native race." His action seems to be justified.

3. **Alopecurus geniculatus** L.—This was apparently first collected by Colenso in North Island, and by Lyall in South Island. It is much more common in North Island than the citation of special localities in the *Manual* would suggest. The species is a compound one, and whether there are indigenous forms or not we do not know, but in the great bulk of its present stations it is almost certainly introduced.

4. **Atriplex patula** L.—This was accepted by Hooker in *Flora Nov.-Zel.* 1 (1853) 215, for specimens sent by Colenso from the east coast of North Island. Cheeseman remarks (*Manual* ed. 2 (1925) 409) " How far it is indigenous in Australia and New Zealand is now very difficult to determine." We regard it as undoubtedly introduced, as it could hardly have been missed by the earlier collectors had it been present then on the coasts.

5. **Bidens pilosa** L.—Hooker, *Handbk. N.Z. Flora* (1864) 139, records this for " Northern Island," and for " Kermadec Island," but of the former station says " a weed of cultivation, not indigenous." Cheeseman accepts the species without comment. For the mainland, at any rate, it should be excluded from the flora. Oliver (*loc. cit.*, p. 172) accepts it for the Kermadecs.

6. **Callitriche verna** L.—Possibly there are indigenous varieties of this linneon, but there are almost certainly introduced forms also. The " species " in New Zealand need closer investigation. According to several informants it has of recent years shown a marked tendency to increase in slow-flowing waters in North Island.

7. **Calystegia sepium** R. Br.—This was collected by Banks and Solander, but as the " species " is a linneon the question should be taken up whether there exists an indigenous variety or varieties. It is certain that in many stations, cultivated land etc., it is introduced only.

8. **Capsella procumbens** Fries.—Cheeseman remarks (*Manual* ed. 2 (1925) 470) " I doubt this plant being a true native of New Zealand, and Sir J. D. Hooker has expressed the same opinion with regard to its supposed nativity in Australia and Tasmania." In the stations in which we have seen it—clay cliffs at Cape Wanbrow, Oamaru; coast of Otago Peninsula (G. Simpson and J. S. Thomson!) —an exotic origin seems very probable. We think it should be excluded from the flora.

9. **Carex leporina** L.—This was first recorded by Cheeseman as occurring in various places " in the western portion of the Nelson district " (*Trans. N.Z. Inst.* 14 (1882) 301). In the various stations in which we know it we regard it as bearing all the signs of an introduced species. Cheeseman remarks in the *Manual* ed. 2, " It is probably introduced into New Zealand." It should be excluded from the flora.

10. **Centella asiatica** (L.) Urban.—Nannfeldt in his " Revision des Verwandtschaftskreises von Centella asiatica (L.) Urb." (in *Svensk. Bot. Tidskr.*, 18 (1924) 397), removes the New Zealand plant from *Centella asiatica* and revives Colenso's name. The citation for the New Zealand species thus becomes *Centella uniflora* (Col.) Nannfeldt. This action is probably correct, but it still remains to make a proper analysis of the New Zealand forms. Colenso's description in *Trans. N.Z. Inst.* 17 (1885) 239 is based on plants collected on " Wet sides of slopes, gullies near Norsewood," and evidently refers to one of the low-growing forms found in damp pastures. Plants taken from damp pastures near Feilding, which were then prostrate, with very small, thick, leaves on short petioles, have in cultivation in the junior

author's garden become quite luxuriant and show little if any difference from the form found in forest, or in shade in boggy places in the same locality. The forms would thus appear to be epharmones of a single jordanon.

11. **Chenopodium ambrosioides** L.—Hooker in the *Handbk. N.Z. Flora* (1864) 230 says "Northern Island: cultivated ground, *Colenso*, perhaps introduced." He also cites Hector and Buchanan as having collected it in the "Waitaki Valley and lake district." Cheeseman in the *Manual* ed. 2 (1925) 407, gives only North Island stations, and remarks "Has appeared as a naturalized plant near Wellington." We remove it from the flora without hesitation.

12. **Chenopodium carinatum** R. Br.—The acceptance of this rests purely on its collection at the Bay of Islands by R. Cunningham in 1834. The station given by A. Cunningham (*Mag. Zoo. and Bot.* 1 (1838) 456) is "sandy shores of the Bay of Islands." Cheeseman in the *Manual* ed. 2 (1925) 407 says "May be truly native in the North Auckland Peninsula. Elsewhere it is doubtless naturalized." Now, by 1834, there had been ample time and opportunity for the plant to have been brought to the Bay of Islands, and for it to have spread considerably. We consider it should be removed from the flora.

13. **Chenopodium urbicum** L.—Hooker in the *Handbk. N.Z. Flora* (1864) 230 cites Colenso as having collected this in North Island, and Haast from "Ashburton River and Rangitata range," and also "New River, *Hb.* A. Richard." Cheeseman in the *Manual* ed. 2 (1925) 407, states it to be not uncommon in South Canterbury and Otago, and cites Colenso as having gathered it on the east coast of North Island. He adds, "Has also appeared as a naturalized plant near Wellington." The species should certainly be excluded from the flora.

14. **Cordyline terminalis** Kunth.—Cheeseman accepts this for the Kermadec Islands in the *Manual* ed. 2 (1925) 310, but Oliver (*loc. cit.*, p. 173), after careful study of the plants now occurring there, states "I have no hesitation in including it among the list of plants introduced by man." We consider this the correct course to take.

15. **Cotula australis** Hook. f.—According to Hooker in *Handbk. N.Z. Flora* (1846) 141 this is the *Soliva tenella* of A. Cunn. in the "Precursor" (*Mag. Zoo. and Bot.* 2 (1839) 128). Cunningham's plant was collected by R. Cunningham in 1834 "on the margins of fresh-water streams." We have not seen it in any station where its nativity appeared at all certain, and we leave it in the flora with considerable doubt.

16. **Cuscuta densiflora** Hook. f.—As Cheeseman remarks, this is "very imperfectly known, and may not be truly indigenous." The specimens on which Hooker founded his species were said to have been collected by Lyall at Port Underwood, Marlborough. It is desirable that further search be made.

17. **Cyperus tenellus** Linn. f.—Hooker in the *Handbk. N.Z. Flora* (1867) 745 gives the record "abundant in the Newton and Dedwood districts, Auckland, *Mr. Kirk*," and adds "probably introduced both into Swan River and New Zealand." Cheeseman in *Manual* ed. 2

(1925) 215, says " doubtfully indigenous in temperate Australia and New Zealand." We do not hesitate to remove it from the flora.

18. **Cyperus vegetus** Willd.—Cheeseman states in the *Manual* ed. 2 (1925) 215, " there can be no doubt that it exists only as an introduced species in New Zealand." With this we fully agree, and accordingly remove it from the flora. He further states that he retains it in the flora " because it has been twice described as an indigenous species, and on account of the remarkable fact that wherever found it presents all the apperance of a true native, and would certainly be taken as such by any one unacquainted with its origin." To us these reasons do not seem valid; moreover, we have seen the plant associated with exotic species in sandy river-beds, ditches, damp pastures, and by the roadside.

19. **Elatine americana** Arn. var. **australiensis** Benth.—A. Cunningham (*Mag. Zoo. and Bot.* 4 (1840) 26) created his species *E. ? gratioloides* for a plant collected by R. Cunningham " In a bog at Tauraki, Hokianga River." Hooker, both in *Flora Nov.-Zel.* 1 (1853) 27, and in the *Handbk. N.Z. Flora* (1864) 28 gives *E. gratioloides* as a synonym for the American species *E. americana.* Bentham in *Flora Austral.* 1 (1863) 178 had given the varietal name *australiensis* for the Australian and Tasmanian plants. T. Kirk, and Cheeseman in both editions of the *Manual,* considered Bentham's variety well founded, and adopted it for the New Zealand plant. Niedenzu, however, in *Die Natuerlichen Pflanzenfamilien* 21 (1925) 276, restores Cunningham's name for the New Zealand, Australian, and Tasmanian species. From the differentiae given by him we consider this the best course to take. Hence the name *E. americana* disappears from the flora, if this view be upheld.

20. **Festuca rubra** L.—Cheeseman in both editions of the *Manual* has these remarks, " According to Professor Hackel, this constitutes the greater part of the *F. duriuscula* of the ' Flora Novae-Zelandiae ' and the *Handbook,* the true *F. duriuscula* probably not existing in an indigenous state in New Zealand. . . It has considerable value as a sheep-grass, and is often sown on sheep-runs." In ed. 2 he adds (p. 206) " From that fact it is doubtful whether some of the European forms that can now be readily collected even in remote districts may not have been introduced. Of some varieties, however, there is no reason to doubt their nativity." We are not, however, given any diagnoses by which we may recognize them. Now to Hackel *Festuca rubra* L. was a huge compound species. Already in 1882 (*Monographia Festucarum europaearum,* p. 128) he had described six subspecies, with many varieties and subvarieties, and to us it seems to serve no useful purpose to include *F. rubra* L. in the New Zealand flora as a sort of dumping-ground for forms of *festucae* for which we cannot find any more suitable resting-place. Moreover it is highly probable that the now far-spread introduced species and varieties have hybridized with indigenous ones, so that our knowledge of this group is chaotic. The whole matter will have to be investigated *de novo* in the field; it cannot be done abroad by the herbarium method: and to us the only profitable course seems to be to admit to the flora only those " varieties " which have shown themselves by genetic

research to be jordanons, and which cannot be matched with exotic varieties. That this will be a task of extreme complexity is obvious. That it will ever be done we are not so sure! But better by far left undone than have names based on a few scraps collected anyhow.

21. **Geranium molle** L.—As already explained, this species should undoubtedly be removed from the flora, where it never should have appeared.

22. **Gypsophila tubulosa** Boiss.—L. Cockayne in *Trans. N.Z. Inst.* 45 (1913) 255 gave as his reason for doubting that this species is indigenous the fact that "*it has never been found in really virgin country*, but always in places where sheep graze." Cheeseman in the *Manual* ed. 1 (1906) 62 had stated that "no evidence has ever been obtained in support of such a view." This statement is retained in ed. 2 (1925) 420, and he further argues that it is highly improbable that a plant found only in South Europe should reach New Zealand sufficiently early to be well established in 1834, when Colenso gathered it. He continues "On the assumption that it is a naturalized plant, it is also difficult to account for the fact that it has not further increased its range during the last fifty years." Hooker in the *Handbk. N.Z. Flora* (1864) 22 says "it is worth observing whether it is rapidly increasing for if so it is probably an importation." In the appendix (1867) 725 he remarks "appears to be rapidly spreading over New Zealand, and is, doubtless, an imported plant." We may point out that such increase has been enormous in Central Otago, and further field observations have given us no reason to modify the statement of 1913.

23. **Imperata arundinacea** Cyr. var. **Koenigii** Benth.—In the *Manual* ed. 2 (1925) 136 Cheeseman says "Perhaps introduced only, but it is one of those species which might be expected to be indigenous in the extreme north of the Dominion,* and I have consequently given it the benefit of the doubt." It was recorded in ed. 1 with the same remarks, as collected by R. H. Matthews near Kaitaia. No further collections are given in ed. 2. Where there is grave doubt our opinion is that it is better to exclude than include, especially in view of the great importance now apt to be attached to the study of those non-endemic supposedly indigenous species called by Willis "Wides" in his "Age and Area theory."

24. **Juncus bufonius** L.—This was admitted to the flora by Hooker, without any expression of doubt, and this course was followed by Cheeseman in ed. 1 of the *Manual.* In ed. 2 p. 296, however, he remarks "Doubtless introduced with grass-seed in the early days of colonization." Our field observations strongly support the view that it is introduced only, and we remove it from the flora.

25. **Juncus lampocarpus** Ehr.—This was first recorded in *Trans. N.Z. Inst.* 7 (1875) 378 by Kirk, who gathered it "about Karori and other places in the vicinity of Wellington," and in "the southern part of the province of Otago." He points out as features distinguishing the New Zealand plant from British specimens, the internal divisions of the leaf and stem more prominent, while both the inner and

*Of course "the extreme north of the Dominion" is in Polynesia and not in the New Zealand Region.

outer segments of the perianth are acute and much shorter in relation to the capsule." Cheeseman admits it to the flora with some doubt. Possibly there is both an indigenous and an introduced variety. Fresh study of the species in New Zealand is desirable.

26. **Juncus tenuis** Willd.—This was first recorded by Cheeseman in *Trans. N.Z. Inst.* 11 (1879) 433. His specimens were collected in 1875 " near Omano " on the Northern Wairoa River. He remarks " So many European plants are becoming naturalized in the colony that additional evidence will be required before *Juncus tenuis* can be included in the list of our indigenous species." In both editions of the *Manual* he refers to its increase in range, and considers it " a very doubtful native." From field observations we are satisfied it should be removed from the flora.

27. **Kyllinga brevifolia** Rottb.—This was collected first by Ball in " marshy ground on the north side of Mongonui harbour " and recorded by Cheeseman as *K. monocephala* Rottb. in *Trans. N.Z. Inst.* 11 (1879) 434. He remarks " So far as I can judge from the information supplied to me the plant appears to be truly indigenous; indeed it is precisely one of those species which might naturally be expected to occur in the northern extremity of the island." In the *Manual* ed. 1 (1906) 765 Cheeseman says " possibly only naturalized in New Zealand," and its range is given as from Mongonui and Ahipara to the North Cape. In *Trans. N.Z. Inst.* 51 (1919) 90 Cheeseman records it from near the Manakau Harbour, remarking " In this locality it is certainly a recent introduction . . . But its nativity in any part of New Zealand must be regarded as exceedingly doubtful." In the *Manual* ed. 2 (1925) 214, however, the less emphatic expression of ed. 1 is retained. We think the species should be removed from the flora.

28. **Mesembryanthemum aequilaterale** Haw.—This was included in the flora by Kirk in *The Student's' Flora* (1899) 184. The station given is " North Island: littoral. Napier (identified in the absence of flowers) : Castle Point." There is no other record. In both editions of the *Manual* Kirk's specimens cited as having been seen by Cheeseman. But Cheeseman remarks in ed. 2, p. 416, " I have seen no indigenous specimens." It seems best to exclude the species from the flora.

29. **Paspalum Digitaria** Poir.—Apparently this was first collected in New Zealand by Cheeseman, near Ahipara. In *Trans. N.Z. Inst.* 46 (1914) 6 Cheeseman remarks, " Of late years this has increased enormously in the Lower Waikato." In both editions of the *Manual* it is stated, " probably introduced." The species should be removed from the flora.

30. **Polygonum aviculare** L.—Cheeseman, in both editions of the *Manual*, states that he retains the species in the flora only because of " the positive opinion expressed in favour of its nativity by the late Mr. Kirk." It seems unnecessary to review the arguments of Kirk and Travers in various papers in *Trans. N.Z. Inst.* 4 and 5, but in view of all the evidence, and our own field observations we unhesitatingly exclude the species from the flora. As for the closely related *P. plebeium* we are pretty certain that stunted forms of *P. aviculare*

have been so referred, but even if it be in New Zealand it has probably been introduced.

31. **Ranunculus sessiliflorus** R. Br.—Hooker in the *Handbk. N.Z. Flora* (1864) 9 cites Colenso as the original collector, and remarks "perhaps introduced." Cheeseman in both editions of the *Manual* says of it "once very plentiful, but now becoming rare." We think the species were better excluded.

32. **Salsola Kali** L.—According to Hooker in the *Handbk. N.Z. Flora* (1864) 233, Colenso, who first collected the plant in New Zealand, observed that the plant was perhaps introduced. Cheeseman in the *Manual* ed. 2 (1925) 412, speaks of it as "of very doubtful nativity in New Zealand." We consider it better to exclude the species from the flora.

34. **Solanum nigrum** L.—Banks and Solander collected what is believed to be this on Cook's first voyage, so a form of the compound species is undoubtedly indigenous. Whether this form truly matches any form of other regions we cannot possibly say, but it is certain that more than one jordanon now occur in New Zealand. Dr. J. P. Lotsy felt sure what he saw was distinct from what he knew in Europe. Almost certainly many of the individuals met with in the settled country are of exotic origin. The epharmones of plants growing in shade and in the open respectively are very distinct in appearance.

34. **Sonchus oleraceus** L.—In the *Handbk. N.Z. Flora* (1864) 166 *S. oleraceus* L. var. α is stated to be "perhaps only introduced." Kirk in *The Students' Flora* (1899) 362 rightly treats it as a naturalized species only. Cheeseman, however, in both editions of the *Manual* accepts it with some doubt. We think it should be removed from the flora.

35. **Sonchus asper** Hill.—This is the *S. oleraceus* var. β of the *Handbook*, p. 166. Hooker says of it, "Certainly indigenous, being found by *Banks and Solander* and *Forster*, and at Chalky Bay by *Lyall*, and in the interior of the Northern Island by *Colenso*." Of these collections that of Banks and Solander is the one of most moment in the argument. T. Kirk in *Trans. N.Z. Inst.* 26 (1894) 265, described the plant of maritime cliffs as *S oleraceus* L. γ *littoralis*. He makes the significant remarks "I have never seen this form on cultivated land, and, as far as I am aware, it is absolutely restricted to maritime localities. The singular absence of variation is a remarkable feature when this plant is compared with the typical form and varity β . It seems not unlikely that the plant observed by Banks and Solander is identical with var. *littoralis*, the fruits of which resemble those of var. β, but are slightly larger. This point could doubtless be settled by an examination of the specimens in the Banksian Herbarium." This opinion is reinforced by the fact that the collections of Banks and Solander were made on the coast, and there is hardly a doubt also that the Chalky Bay plant collected by Lyall was var. *littoralis*. L. Cockayne in *Rep. Bot. Survey of Kapiti Id.* (1907) 21 raised the coastal plant to the rank of a species as *S. littoralis* (T. Kirk) Ckn. This action we consider amply justified and

it has been supported by Carse and others. It is highly desirable that the specimens of Banks and Solander be re-examined, but we have little or no hesitation in removing *S. asper* from the list of indigenous species. The two introduced species hybridize freely, thus accounting, in part, for the great " variability," but there are doubtless several jordanons in each.

36. **Sporobolus indicus** R. Br.—Cheeseman in both editions of the *Manual* states of this " it is certainly introduced," and cites Bishop Williams's statements as to its first appearance at the Bay of Islands. The species should be excluded from the flora.

37. **Stipa setacea** R. Br.—This is first recorded by Petrie in *Trans. N.Z. Inst.* 19 (1887) 326. He says " Several years ago I found this grass at Firewood Creek, Cromwell, and the Nevis Bluff, Kawarau River. As the plants were confined in these localities to small areas, and these were near an important highway, it was uncertain whether the species had not been accidentally introduced. In March of the present year [1886] I found it on the banks of the Waitaki River at Wharekuri. The discovery of this widely-distant habitat is sufficient to remove all reasonable doubt as to its being a genuine native of New Zealand." His reason for accepting the species does not to us seem cogent. The plant is eaten by sheep, and the fruits might easily be carried by them to runs at considerable distances, just as species of *Danthonia* are so carried. Cheeseman in the *Manual* ed. 2 (1925), p. 150, says " It is probably naturalized in New Zealand." We would remove the species from the flora.

38. **Veronica anagallis-aquatica** L. — This was collected by Colenso in " watery places " at Hawke's Bay, and was accepted by Hooker without expression of doubt. Cheeseman in the *Manual* ed. 2 (1925) 832 says " Possibly Mr. Colenso's specimens were introduced as well [as in South Africa]; but if so, it is remarkable that the plant should have apparently disappeared." We have no hesitation in removing it from the flora. It is not likely that a close search would secure a rediscovery of it. A closely allied species that has as yet not been certainly identified, occurs as a naturalized plant by the banks of the Waitaki River, near Glenavy. *V. scutellata,* also, is so far known as naturalized in New Zealand only in one small patch of *Typha* swamp near Feilding. All three records are thus from places subject to great modification during settlement, and might easily disappear before they had had a chance of spreading far.

3. Phytogeographic.

The following does not by any means exhaust the list of unpublished localities of which we are cognizant. But as the second edition of the *Manual* must of necessity be the starting point, *notwithstanding earlier publication of any locality,* it is essential to study carefully the details in the *Manual* regarding the distribution of each species before adding such additional information as is required. Also the alterations in the conception of many species which are being made from time to time, will alter in no few instances the present dicta regarding the distribution of certain groups. We also deprecate the practice of publishing lists of " hitherto unrecorded habitats "

when the information given provides no real advance in our knowledge of the distribution of the species concerned. It is to be noted also in that in such lists there has generally been given no details of the habitat at all, but merely names of localities.

1. **Agrostis muscosa** T. Kirk.

South Island: Eastern Botanical District—Coastal " loess " cliffs near Ashburton; H. H. A.

2. **Anisotome diversifolia** Cheesem.

South Island: Sounds-Nelson Botanical District—Shingle-slips on Gordon's Knob, *c.* 1500 m.; H. H. A.

3. **Aristotelia fruticosa** Hook. f.

North Island: Waikato Botanical Subdistrict—Kaikuri near Waitomo; E. Phillips Turner.

4. **Arthropteris tenella** (Forst. f.) J. Sm.

South Island: Sounds-Nelson Botanical District—Various localities in subtropical rain-forest in the Marlborough section of the district; E. Phillips Turner, L. C.—Cheeseman had evidently had no specimens from South Island, though he cites the occurrence of the species from near Nelson, and on Banks Peninsula on the authority of T. Kirk and J. B. Armstrong respectively. R. M. Laing does not give it in his list, but W. Martin records it on the authority of D. G. Riches of Akaroa, who stated he had seen it but " exact locality forgotten."

5. **Celmisia coriacea** Hook. f. var. stricta Ckn.

South Island: South Otago Botanical District—On all the higher mountains. Cheeseman records it only from the Takitimu mountains where the " type " was collected. It apparently increases after the tussock-grassland is burnt.

6. **Corokia buddleoides** A. Cunn. var. **linearis** Cheesem.

North Island: Thames Botanical Subdistrict—Mangarewa Gorge on the Mamaku Plateau, in open forest; L. C.

7. **Dichelachne sciurea** (R. Br.) Hook. f.

South Island: (1) North-western Botanical District—near Greymouth, T. Kirk; in open manuka shrubland, H. H. A. Cheeseman had " seen no specimens " from that locality and merely quoted Kirk's record. (2) Western Botanical District—near Hokitika, in open manuka shrubland, H. H. A.

8. **Epilobium rubromarginatum** Ckn.

South Island: Western and Eastern Botanical Districts at their junction—almost certainly the plant referred to *E. tasmanicum* by A. Wall in his *Flora of Mount Cook* from high altitudes is this species, which L. C. saw in abundance on the Sealey Range.

9. **Gaultheria antipoda** × **oppositifolia.**

North Island: (1) Volcanic Plateau Botanical District—Near Lake Rotoma, on rock faces, common; J. P. Lotsy and L. C. (2) Egmont-Wanganui Botanical District—Mount Messenger on road-cutting, H. H. A.

10. **Gaultheria oppositifolia** Hook. f.

North Island: Egmont-Wanganui Botanical District—Pipiriki, E. Phillips Turner; Mount Messenger, E. P. Turner, H. H. A.

11. **Gnaphalium Lyallii** Hook. f.

South Island: (1) Eastern Botanical District—Rakaia Gorge, on rocks by stream-side in forest, H. H. A. (2) North-eastern Botanical District—Shale Peak on rock in shade, L. C. in 1898. Cheeseman (*Manual* ed. 2 (1925) p. 963) only records this species from the western side of South Island, from " Collingwood to Milford Sound."

12. **Gnaphalium trinerve** Forst. f.

South Island: Eastern Botanical District—Rakaia Gorge, on rock by streamside in forest, H. H. A. Cheeseman (*Manual* ed. 2, p. 964) has no record for the east of South Island, but he saw H. H. A.'s specimens, and quite concurred in the identification.

13. **Helichrysum prostratum** Hook. f.

North Island: Volcanic Plateau, East Cape, Egmont-Wanganui, and Ruahine-Cook Botanical Districts—abundant on all the high mountains. *H. bellidioides* (Forst. f.) Willd., so far as we know, does not occur in North Island. Of course it is possible that the true *H. prostratum* is restricted to the Subantarctic Province, and if so No. 13 requires a name. Cheeseman says of *H. prostratum* "sparingly found in both North and South Islands," but we do not know it from South Island. Regarding the matter of sessile to long-pedunculate heads either species may exhibit heads of this character.

14. **Helichrysum bellidioides × Glomeratum** Ckn. et Allan = in part **H. Purdiei** Petrie.

South Island: (1) North-eastern Botanical District—Valley of the Clarence, Aston! (2) South Otago Botanical District—inland from Dunedin, G. Simpson and J. S. Thomson; near Arrowtown, L. C.

15. **Hymenanthera crassifolia × obovata.**

(a) North Island: Ruahine-Cook Botanical District—Neighbourhood of Wellington, Aston! (b) South Island: Sounds-Nelson Botanical District—Coast near mouth of R. Whangamoa, L. C.

16. **Lagenophora cuneata** Petrie.

South Island: Eastern Botanical District—Mount Peel, in tussock-grassland, H. H. A. We cannot discuss this species in this place, but suggest that it may be the *true Lagenophora petiolata* Hook. f., in that the heads are much smaller than in either *L. pumila* or Cheeseman's conception of *L. petiolata;* but we confess regarding the two last that we are never really sure of our identifications.

17. **Leptospermum scoparium** Forst. var. **incanum** Ckn.

North Island: North Auckland Botanical District and probably Kaipara Botanical Subdistrict—The type came from near Rangaumu Harbour, but apparently the variety is of local distribution as indicated above. Cheeseman (*Manual* ed. 2 (1925) 588) gives no localities for the variety.

18. **Muehlenbeckia complexa × ephedroides.**

South Island: North Otago Botanical District—near Kurow, on old flood-plain of R. Waitaki in scrub, L. C. Only one plant was seen but it showed most clearly the combination of parental characters.

19. × **Muehlenbeckia muricatula** (Col.) Ckn. et Allan as hyb. (*M. axillaris* × *ephedroides*).

South Island: (1) North-eastern Botanical District—Awatere Valley, Aston! (2) Eastern Botanical District—Along the Ashburton R., coastal to well inland, H. H. A.

The above name we only propose for the small group of hybrids intermediate between the two parents (= *M. muricatella* Col. in *Trans. N.Z. Inst.* 22 (1890) 482). For the whole hybrid group we intend to give the name × *M. axephedra*, but without a Latin diagnosis this is only a *nomen nudum*.

20. **Myosurus novae-zelandiae** W. R. B. Oliver.

South Island: Eastern Botanical District—Near the Ashburton R. on the Canterbury Plain in bare places, H. H. A. This species has also increased to an almost unbelievable degree where the tussock grasses have been destroyed in semi-arid Central Otago (North Otago Botanical District).

21. **Nertera Balfouriana** Ckn.

South Island: (1) North-western Botanical District—The St. Arnaud Mountains, by subalpine streams and tarns, H. H. A. (2) South Otago Botanical District—To west of the New River Estuary in low, flat, moist, sandy ground, L. C. in *The Vegetation of New Zealand*, 1921, p. 69. (This locality is omitted in the *Manual* ed. 2).

22. **Nothopanax anomalum** × **simplex**. [The hybrid midway between the two parents is × *N. parvum* (T. Kirk) Ckn. as hyb.].

South Island: Fiord Botanical District—The Spey Valley in *Nothofagus* forest, extremely abundant and polymorphic; W. A. Thomson!, L. C.

23. **Nothopanax Colensoi** × **simplex**.

South Island: Sounds-Nelson Botanical District—Near the track to the Dun Mountain; F. G. Gibbs and J. P. Lotsy! This is probably *Nothopanax Macintyrei* Cheesem. in *Manual* ed. 2, p. 636, which was described from a garden plant. We have seen similar forms, probably close to this hybrid in *Nothofagus* forest near Murchison, H. H. A., and in forest on the Pikikiruna Range, L. C. (North-western Botanical District.)

24. **Olearia albida** Hook. f.

North Island: Egmont-Wanganui Botanical District—At mouth of R. Mokau; E. Phillips Turner, H. H. A. and K. W. Dalrymple.

25. **Olearia arborescens** × **lacunosa**.

South Island: North-western Botanical District—Near source of R. Inangahua, by side of stream, L. C.

26: **Olearia Crosby-Smithiana** Petrie.

South Island: Fiord Botanical District—Mountains near Wilmot Saddle; W. A. Thomson, L. C.

27. **Olearia divaricata** Ckn.

South Island: Fiord Botanical District—Near Wilmot Saddle in open, boggy ground, L. C. Not previously recorded from South

Island but supposed to be confined to Stewart Island. *O. Macphersoni* Ckn. (name only) in *Flora,* n.f. 18 (1925) 76 is a synonym. Mr. W. A. Thomson has sent us from near Lake Hauroko a series of forms which appear to be *O. divaricata* × *lineata*. One remarkable specimen carries leaves, some of which have the rusty tomentum of *divaricata,* others the white of *lineata*, and others again which are intermediate in colouring.

28. **Ourisia glandulosa** Hook. f.

South Island: North-western Botanical District—Mount Mantell, in subalpine herb-field, H. H. A. Only recorded by Cheeseman (*Manual* ed. 2, p. 838 for certain localities in Otago, but Townson (*Trans. N.Z. Inst.*, vol. 39, 1907, p. 419) recorded it from the Paparoa Mountains (North-western Botanical District). The same, or a closely similar species, occurs by tarns on the St. Arnaud Mountains.

29. **Ourisia modesta** Diels.

South Island: Fiord Botanical District—Exact locality to be given in the next part of this series, W. A. Thomson! Previously only known from Stewart Island, and only from one locality and one plant!

30. × **Plagianthus cymosus** (T. Kirk) Ckn. et Allan as hyb. (= *P. betulinus* × *divaricatus*).

North Island: Ruahine-Cook Botanical District—Miramar Peninsula, E. Phillips Turner! *Plagianthus betulinus* has not been recorded from that locality, but no one can say whether it has been there or the contrary, nor would its absence be evidence that the plant is not of hybrid origin.

31. **Pomaderris phylicaefolia** Lodd.

South Island: Eastern Botanical District—Canterbury Plain, near Horrelville, in the extensive *Leptospermum* thicket association north of the R. Waimakariri, E. Phillips Turner. This is the first record for this species in South Island. In North Island it reaches from the far north to Otaki and Cape Palliser (*Manual* ed. 2, p. 555), but is very rare in the Ruahine-Cook Botanical District, and absent in its extreme southern part. To learn of its occurrence in Central Canterbury, while aware of its absence elsewhere in South Island, has occasioned us no small surprise and were the record not from one with such certain knowledge of the species as Mr. Turner possesses we should not have accepted the statement without further enquiry. It is, indeed, one of the most sensational records of distribution that have been made for some years in New Zealand, and it almost equals Mr. W. R. B. Oliver's discovery of *Metrosideros Parkinsonii* on Great Barrier Island. (Since the above was written Mr. Turner has sent us a specimen from the Canterbury Plain).

32. **Suttonia chathamica** (F. Muell.) Mez.

South Island: Sounds-Nelson Botanical District—(1) Red Hill, on the Mineral Belt, A. R. Wastney! (2) Whangamoa Valley, amongst small trees and shrubs on the bank of the river, E. C. Jeffrey and L. C. If this is not as referred above then it is an undescribed species. Only known previously from the Chatham Islands, where it is common, and from one or two localities in Stewart Island—close to the sea.

The Vegetation of Mount Peel, Canterbury, N.Z.

Part 2.*—The Grasslands and Other Herbaceous Communities.

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A. THE GRASSLANDS.

(a.) GENERAL.

BOTH low and tall tussock-grassland are well developed at Mount Peel. The tendency of sown grassland, after felled forest, to be succeeded by *Poa caespitosa* grassland has already been referred to. In this section the modified tussock-grasslands of the montane and the subalpine belts are discussed. In the communities previously described exotic plants are of quite minor importance, but in the grasslands they are of considerable significance, especially from the economic point of view, and they are therefore more fully referred to. In the lists exotic species are distinguished by an asterisk.

The montane low tussock-grassland appears to be a climax association, forest being inhibited by the prevailing strong winds, and by the rainfall falling below the critical point for forest establishment, except in the sheltered gullies such as that of the Lynn stream.

The association clothes the lower slopes of the spurs and valleys facing towards the Rangitata and the Orari rivers, and is replaced at an elevation of some 600 m. by tall tussock-grassland. The dominant species are *Poa caespitosa* and *Festuca novae-zealandiae* in varying proportions.

The tall tussock-grassland is the most extensive association at Mount Peel, forming a broad belt between the altitudes, roughly, of 700 m. and 1300 m. Above it merges, often by insensible degrees, into fell-field, and in special circumstances into herb-field; below, it is also often impossible to draw a definite line of demarcation between the tall and the low tussock-grassland. Very clear in the grasslands is the fact that the depth and duration of lie of the snow is the major factor in deciding the altitudinal range of the belts. Very marked, too, is the great change as one passes over from the exposed sunny slopes facing the Rangitata to the more sheltered and shaded southern-facing slopes. The rather open association of the one side is replaced by a compeltely closed association on the other. The sole dominant is *Danthonia flavescens*. *D. Raoulii* var. *rubra* is rare, and confined to sour, boggy ground.

(b.) *FESTUCA NOVAE-ZEALANDIAE—POA CAESPITOSA* ASSOCIATION.

1. *Composition and Structure.*

The number of indigenous species considered true members of the association is 102, representing 74 genera and 33 families. There are

*Part I. in *Trans. N.Z. Inst.*. vol. 56, p. 37.

7 pteridophytes, 30 monocotyledons, and 65 dicotyledons. Of these 53 are more or less common, 40 infrequent or local, and 9 rather rare. There are 17 species of Gramineae, 16 of Compositae, and 13 families are represented by 1 species each.

The growth-forms represented are:—5 small tuberous-rooted summer-green herbs; 13 simple rosette plants; 33 tuft-plants, including 12 tussock or semi-tussock plants; 3 trailing herbs; 36 creeping plants, including 7 turf-forming plants, 16 mat-forming plants; 12 bushy plants, including 4 shrubs and 1 tuft-tree. These may be grouped as herbaceous 77, semi-woody 17, woody 8.

Though the general physiognomy is similar throughout and only one association is recognized, detailed examination shows that the composition varies from place to place. In general *Festuca novae-zealandiae* is dominant over very considerable areas, with *Poa caespitosa* sub-dominant; but there are also large areas where the relative importance of the two species is reversed, or where the two are present in approximately equal amounts. Abundant members are *Agropyron scabrum*, its long drooping flowering culms forming in season a striking feature on many slopes, **Agrostis vulgaris, Dichelachne crinita*, **Anthoxanthum odoratum*, **Rumex Acetosella, Hydrocotyle novae-zelandiae* var. *montana, Nertera dichondraefolia*, **Hypochaeris radicata, Helichrysum filicaule, Cotula squalida. Poa Colensoi, Danthonia semi-annularis* and *D. pilosa*, although very common, do not assume the importance or dominance they have in certain low tussock-grassland communities elsewhere. Other very common species are *Carex breviculmis, Luzula campestris* vars., *Ranunculus multiscapus, Acaena Sanguisorbae* vars., especially var. *pusilla* (but not remarkably aggressive), *Geranium sessiliflorum* vars., *Oxalis corniculata, Epilobium chloraefolium* var. *verum, Oreomyrrhis andicola* var. *ramosa, Deyeuxia avenoides* var. *brachyantha, Wahlenbergia gracilis* vars., *Celmisia spectabilis, Vittadinia australis* var., *Gnaphalium collinum, Helichrysum bellidioides*, **Trifolium repens*, **T. dubium*, **Holcus lanatus*, **Crepis capillaris*, **Cerastium vulgatum*.

Often of physiognomic importance are *Phormium Colensoi, Cordyline australis, Fuchsia Colensoi, Carmichaelia subulata*, this last now closely eaten down. *Aciphylla Colensoi* is now quite uncommon, odd plants indicating the probable sites of the once striking colonies. *Aciphylla squarrosa*, now rare except along road-sides, was probably also common, as may have been *Angelica montana*, now only to be found in places inaccessible to sheep.

On much insolated and wind-bitten slopes the low tussock-grassland may ascend to about 1000 m. altitude, while on steep, shaded spurs tall tussock-grassland may descend to 300 m. Closer examination reveals how surely the composition of the grassland changes in accordance with apparently quite minor variations of slope and aspect. On concave slopes *Poa caespitosa* at once becomes abundant, with often an increase of *Agropyron scabrum* and **Agrostis vulgaris*. Here also will occur **Holcus lanatus, Hydrocotyle novae-zelandiae* var. *montana, Chrysobactron Hookeri* var. *angustifolia, Viola Cunninghamii, Pratia angulata, Microlaena stipoides, Poa Kirkii* var., *Carex Colensoi, Ranunculus hirtus, Epilobium nerterioides, Anisotome aro-*

matica var., *Senecio bellidioides*, with perhaps odd tussocks of *Danthonia flavescens*.

Small steep banks usually show *Senecio bellidioides, Viola Cunninghamii, Viola filicaulis, Anisotome arómatica, Asplenium flabellifolium, Lycopodium fastigiatum,* in fair quantity.

On flushed ground *Juncus polyanthemos* var., *Schoenus pauciflorus* and *Carex ternaria* form colonies, pure or mixed. Here generally is much *Chrysobactron Hookeri* var. *angustifolia,* and with other plants coming in, *e.g. Mazus radicans, Oreobolus pectinatus,* small areas of bog are developed. On dry concave slopes numerous examples of *Cordyline australis* may occur, presenting a park-like appearance.

On steeper concave slopes much exposed to wind and sun we have a complete contrast. Where not actually occupied by debris scrub, such slopes present an intermediate character. The grassland is open, *Pteridium esculentum* is often abundant, with sometimes *Hypolepis Millefolium* and *Paesia scaberula.* Very often there is much **Verbascum Thapsus,* **Digitalis purpurea* and **Cirsium lanceolatum.* Odd plants of *Discaria toumatou, Muehlenbeckia complexa, Rubus australis, R. cissoides, R. subpauperatus* and *Coprosma parviflora* may be dotted about.

Convex slopes and ridges are characterized by the dominance of *Festuca novae-zealandiae*, and the presence of much *Helichrysum filicaule, Leucopogon Fraseri, Blechnum penna marina* and *Scleranthus biflorus.* Other plants more frequent here are *Deyeuxia avenoides* var. *brachyantha, Triodia pumila, Echinopogon ovatus, Muehlenbeckia axillaris, Halorrhagis procumbens, Vittadinia australis* var., *Raoulia subsericea* and *R. Monroi.*

Where dry rocky outcrops occur the following are usually met with: *Poa Colensoi, Danthonia setifolia, Luzula campestris* vars., *Colobanthus acicularis, Angelica montana, Wahlenbergia albomarginata, Tillaea Sieberiana, Hebe amplexicaulis, Coprosma brunnea, Brachycome Sinclairii,* with certain of the common grassland plants, *e.g. Leucopogon Fraseri, Celmisia spectabilis.* Where the rocks are damper and more shaded *Hymenophyllum multifidum, Anisotome aromatica* vars., and *Senecio bellidioides* will also be present. At the bases of the rocks, if miniature débris slopes are formed, *Rubus* spp., *Hymenanthera dentata* var. *alpina* and other plants of the débris scrub association may be present.

The larger streams in the grassland have their banks occupied by more or less well-developed gully forest. On the smaller ones this is reduced to a thin shrubby margin with *Olearia avicenniaefolia* and *Hebe salicifolia* var. *communis* predominating. Quite small streams are often marked out by lines of *Arundo conspicua,* broken by sheets of *Carex ternaria* and *Juncus polyanthemos* var., or *Schoenus pauciflorus.*

2. *Successions.*

Certain secondary successions now in progress are here dealt with. Where excessive burning has occurred two successions are set up on sunny slopes that have suffered severely. Both of these probably

resemble in a measure the primary successions on such slopes, with the modifications due to the presence of relics of the original grassland cover, the presence of exotic plants in the neighbourhood, and the presence of stock.

Concave slopes revert to an open débris community in which *Pteriduim esculentum* is dominant. *Rubus australis, R. subpauperatus, R. cissoides* occur, usually in quantity, and *Epilobium cinereum, E. hirtigerum,* **Verbascum Thapsus,* **Rumex Acetosella, Coriaria sarmentosa* and **Hypochaeris radicata* may be abundant. Where consolidated tracks cross these débris slopes *Pteridium esculentum* disappears and *Poa caespitosa* or *Festuca novae-zealandiae* may be plentiful.

In the rabbit-infested area of the Orari side certain burnt-over slopes covered in fine débris are still further depleted of their grassland species, and **Verbascum Thapsus* is now present in great quantities, with little else but **Rumex Acetosella* and *Epilobium nerterioides*. In a few cases spp. of *Epilobia* are almost the sole plants present.

On other slopes a succession somewhat resembling that occurring on the river-beds is set up. Here on the very open ground *Raoulia subsericea, R. Monroi* and *Celmisia spectabilis* are early comers, the mats of the scabweeds forming a seed-bed for grasses and herbs from the adjacent areas. *Leucopogon Fraseri* and *Helichrysum filicaule* are also common. *Acaena Sanguisorbae* var. *pusilla*, a quite minor feature of the grassland, here becomes aggressive forming mats of fair size. **Rumex Acetosella* and **Hypochaeris radicata* also spread rapidly and occupy much ground, as does *Blechnum penna marina*. *Festuca novae-zealandiae* gradually regains possession; the scabweeds, having played their parts, succumb, and low tussock-grassland is restored.

On the richly manured ground where sheep camp the following form a distinct, if small, community: **Rumex Acetosella,* **Stellaria media,* **Geranium molle,* **Myosotis caespitosa,* **Poa pratensis,* with which may be **Sisymbrium officinale,* **Senecio sylvaticus,* **Marrubium vulgare* (this last not here forming the large colonies often so characteristic of sheep camps). In some camps there are patches of *Cotula squalida* forming a dense turf.

(c.) *DANTHONIA FLAVESCENS* ASSOCIATION.

1. *Composition and Structure.*

This lower subalpine association, although much modified, has far fewer exotic species present, both in number of species and in their quantity. Indigenous species, truly members of the community, number 124, representing 74 genera and 28 families. There are 6 pteridophytes, 40 monocotyledons, 78 dicotyledons. There are 25 species of Gramineae, 22 of Compositae, and 8 of Cyperaceae. There are 10 families represented by 1 species each. There are 69 species more or less common, 48 infrequent or local, 7 rather or quite rare.

The following growth-forms are represented: 2 small tuberous-rooted summer-green herbs; 21 simple rosette plants; 48 tuft plants, including 9 tussock plants; 35 creeping plants, including 18 mat-

forming plants; 18 bushy plants, including 14 shrubs. These may be grouped as 90 herbaceous, 13 semi-woody, and 21 woody plants. While in places all the shrubs appear to be true members of the association, in others they are relicts or remnants of former scrub communities.

The dominant plant throughout is *Danthonia flavescens*, varying in circumference and height according to exposure, elevation, and to the degree of severity of burning to which it has been subjected. There are no plants assuming sub-dominance, but more or less plentiful are: *Lycopodium fastigiatum*, *Carex breviculmis*, *Deyeuxia avenoides* var. *brachyantha*, *Danthonia pilosa*, *Danthonia semi-annularis*, *Agrostis pilosa*, *Luzula campestris* vars., *Viola Cunninghamii*, *Epilobium chloraefolium* var. *verum*, *Anisotome aromatica* vars., *Leucopogon Fraseri*, *Gentiana corymbifera*, *Euphrasia zealandica*, *Nertera dichondraefolia*, *Lagenophora petiolata*, *Helichrysum filicaule*, *H. bellidioides*, *Celmisia spectabilis*, *Senecio bellidioides*, and at the higher levels *Celmisia Lyallii* and *Hierochloe Fraseri*. Other generally distributed species are *Blechnum penna marina*, *Poa Colensoi*, *Agropyron scabrum*, *Stellaria gracilenta*, *Geranium sessiliflorum* vars., *Pimelea pseudo-Lyallii*, *Anisotome filifolia*, *Gaultheria depressa*, *Celmisia gracilenta*. Of exotics **Hypochaeris radicata* and **Rumex Acetosella* are to be met with throughout, especially in the drier areas, while at lower levels the species found in low tussock-grassland may also be met with.

On the sunny exposed slopes, especially as one ascends, the association is more open than elsewhere, largely owing to the periodical burning of the tussocks, which in the upper portions of the belt has induced an extensive fell-field closely resembling the true lower subalpine fell-field. *Celmisia spectabilis* is here extremely abundant, and *Acaena Sanguisorbae* var. *pusilla*, elsewhere insignificant, becomes frequent. *Koeleria* sp., *Deyeuxia avenoides* var. *brachyantha*, *Poa Colensoi*, **Anthoxanthum odoratum*, *Geranium sessiliflorum* vars., and *Scleranthus biflorus* are more frequent than in the less affected parts.

In the closed association of the southern-facing slopes the above-mentioned plants become much less conspicuous, their places being taken by *Anisotome aromatica* vars., *Acaena Sanguisorbae* var. *pilosa*, *Viola Cunninghamii*, *Hydrocotyle novae-zelandiae* var. *montana*. *Gaultheria depressa*, *Forstera Bidwillii*, and especially by a marked amount of *Celmisia coriacea*, *Senecio bellidioides*. Here too are frequent colonies of *Phormium Colensoi*, *Aciphylla Colensoi*, *Astelia Cockaynei*, *Hebe buxifolia* var. *odora*, *Hebe* sp. (*aff. H. Traversii*), and in places *Coprosma serrulata*. The vegetation becomes much more luxuriant, and exotic species are rare or completely absent over wide areas. These variations are repeated on a minor scale and in a less complete way with the varying aspects of the secondary ridges. On some steep, shaded slopes *Blechnum capense* becomes dominant, its brown sheets recognizable from afar, and forming outliers of the *Blechnum capense—Phormium Colensoi* belt next described.

Flushed areas on concave slopes have present in exceptional abundance *Carex ternaria*, *Schoenus pauciflorus*, *Oreobolus pectinatus*,

Viola Cunninghamii, Forstera Bidwillii, Phyllachne Colensoi, Ourisia caespitosa, and a true bog-community may be developed.

The upper portions of the tall tussock-grassland on the steep slopes leading to the main divide have a very distinct appearance, but the transition is a very gradual one. There is great abundance of *Celmisia Lyallii,* often of very large size and becoming almost sub-dominant. The soil is of a raw peaty character, almost boggy over much of the slopes, while the snow cover is dense in winter, and remains long. *Danthonia flavescens* forms smaller tussocks, less densely placed, and between the major plants occur in plenty *Astelia montana, A. Petriei, Celmisia coriacea,* and within the tussocks *Hierochloe Fraseri.* Very common too are *Lycopodium fastigiatum, Poa imbecilla* var., *Microlaena Colensoi, Viola Cunninghamii, Gaultheria depressa, Forstera Bidwillii, Ourisia caespitosa, Coprosma repens, Anisotome aromatica* vars., *Celmisia discolor.* The shrubs *Dracophyllum uniflorum, Hebe buxifolia* var. *odora, Hebe lycopodioides,* are frequent. On similar slopes receiving rather more sun and wind the ground between the tussocks may be almost bare. In such areas *Aciphylla Colensoi* is often conspicuous.

Rocks in the tall tussock-grassland at its lower elevations have a similar assemblage of species to that of the low tussock-grassland rocks. Dry rocks, however, have a greater differentiation of species according to the amount of sun received. On the sun-baked rocks the main species are. *Blechnum penna marina, Poa Colensoi, Luzulu campestris* vars., *Danthonia setifolia, Epilobium pubens* (at the lower elevations only), *Muehlenbeckia complexa, Leucopogon Fraseri, Pentachondra pumila, Scleranthus biflorus, Helichrysum filicaule, Brachycome Sinclairii* (stunted). Shaded rocks are characterized by much more frequent *Asplenium Richardi, Anisotome aromatica* vars., *Suttonia nummularia, Gaultheria rupestris, Celmisia discolor, Senecio bellidioides.*

Damper rocks have much the same cover as those of low tussock-grassland, but *Hymenophyllum multifidum* and *H. villosum* often make close mats on the steeper faces.

At higher elevations come the rock buttresses and rocky spurs with the *Dracophyllum uniflorum* shrubland already described. Along streamsides occur shrub communities, often more or less fragmentary, of the types already described, especially *Hebe* shrublands.

The crests of the spurs are razor-backed and rocky, contrasting with the rounded crests of the lower portions. Characteristic plants, in quantity, of these ridges are *Blechnum penna marina, Lycopodium fastigiatum, Halorrhagis procumbens, Leucopogon Fraseri, Pentachondra pumila,* with the tussocks of *Danthonia flavescens* and the rosettes of *Celmisia spectabilis* smaller and further apart than elsewhere. Frequent also is a woolly form of *Craspedia uniflora,* near akin to *Craspedia alpina.* Burning intensifies this open condition, and then *Pteridium esculentum, Raoulia subsericea,* and the exotics **Anthoxanthum odoratum,* **Hypochaeris radicata* may appear in noticeable amounts.

In various places shallow depressions occur, in which drifted snow collects, and slowly melting forms temporary pools. If of fair size

the hollow may be bare of vegetation towards the centre, but usually there are patches of a dark moss. Surrounding this come scattered depressed tufts of *Poa imbecilla* var., with **Rumex Acetosella* and **Hypochaeris radicata*. Further back still **Agrostis vulgaris* forms a turf, merging into a girdle of *Festuca novae-zealandiae* and *Poa caespitosa* with **Holcus lanatus*, and this again merges as the slope increases into the tall tussock-grassland. At higher elevations *Agrostis muscosa* takes the place of *Poa imbecilla*, and *Carex Wakatipu* that of **Agrostis vulgaris*, while the low tussocks may be infrequent or absent.

2. *Successions.*

Several large slips have occurred in the tall tussock-grassland, especially at its junction with the *Phormium Colensoi–Blechnum capense* belt. On the bare ground exposed by the slip the loose material develops into a miniature shingle-slip of fine débris. The earliest plants to gain root-hold are *Raoulia tenuicaulis*, *Acaena glabra*, *Epilobium pycnostachyum*, *Epilobium melanocaulon* var. *typica* and var. *viride*, *Epilobium pedunculare* var., *Cardamine heterophylla*, *Viola Cunninghamii*, *Myosotis pygmaea* var., and **Rumex Acetosella*. There is thus an interesting assemblage of plants from the river-bed, the true shingle-slips and the adjacent grassland. The circular mats of *Raoulia tenuicaulis* widen at a rapid rate, and on them are established *Poa caespitosa*, *Acaena Sanguisorbae* var. *pusilla*, *Geranium sessiliflorum*, *Helichrysum bellidioides*, **Poa pratensis*, **Hypochaeris radicata*, and, of special moment, *Coriaria lurida* and *C. sarmentosa*. On the stable ground thus formed other plants of the adjacent grassland establish, *Raoulia tenuicaulis* and *Coriaria* form vigorous marginal growth, the various patches finally coalescing to form a close cover, on which *Blechnum capense* and *Danthonia flavescens* become aggressive.

Early comers on to rocks exposed by slips are *Danthonia setifolia*, *Poa Colensoi*, *Anisotome aromatica*, *Angelica montana* and *Olearia avicenniaefolia*.

B. THE *BLECHNUM CAPENSE—PHORMIUM COLENSOI* COMMUNITY.

A belt with *Blechnum capense* dominant, and containing much *Phormium Colensoi* (sometimes co-dominant) occurs between the tall tussock-grassland and the forest or its shrubland margin. On the southern faces towards the Scotsburn Creek the belt is continuous, elsewhere it is interrupted, occurring on steep slopes above the gully forests and dying out as the more gentle slopes above are reached. The ground is peaty and seldom dry. *Blechnum capense* covers the ground in great dense sheets, through which grow the numerous *Phormium* tussocks, while *Aciphylla Colensoi* and *Coriaria sarmentosa* are often frequent. Any of the grassland plants may be found, but few and far between. *Cassinia fulvida* var. *montana*, *C. Vauvilliersii* var., *Hebe buxifolia* var. *odora*, *H. salicifolia* var. *communis*, and *Dracophyllum longifolium* may be present. In some cases a *Hebe* scrub appears to be developing, and in others there is certainly an induced succession dominated by *Cassinia* where fire has succeeded in running through the belt.

C. THE FELL-FIELD COMMUNITIES.

(*a.*) General Composition.

The fell-field belt extends from the tall tussock-grassland to the highest peaks. Although there are several distinct associations, notably the *Celmisia Lyallii* association of the steeper slopes, and the *Celmisia viscosa* association of flatter areas, there are many places where these intergrade, and it seems preferable to note the general composition before describing the associations in some detail. There are 73 species true members of the fell-field, representing 46 genera and 22 families. There are 14 species of Gramineae, 19 of Compositae (7 Celmisiae), while 8 families are represented by 1 species each. There are 2 pteridophytes, 20 monocotyledons, and 51 dicotyledons. The following growth-forms are represented: 9 simple rosette plants; 28 tuft plants, including 6 tussocks; 1 trailing woody plant; 25 creeping plants, including 19 mat-forming plants, and 3 cushion or semi-cushion plants; 10 bushy plants, including 8 shrubs. These may be grouped as 44 herbaceous, 15 semi-woody, 14 woody plants. Of the species 44 are more or less common, 23 are infrequent or local. 6 more or less rare.

(*b.*) *CELMISIA LYALLII* ASSOCIATION.

On the Rangitata faces this association is very open, the surface dries out readily and is composed of coarse, angular, stable débris. *Celmisia Lyallii* is dominant, with *Danthonia flavescens* frequent to sub-dominant. *Celmisia spectabilis* is plentiful, extremely so where burning has been severe, and here the *Celmisia Lyallii* is much less prominent. Quite common are *Poa Colensoi*, **Rumex Acetosella*, *Aciphylla Monroi* var., while fairly frequent are *Koeleria* sp., *Agrostis subulata*, *Deyeuxia avenoides* var. *brachyantha*, *Triodia pumila*, *Poa Lindsayi*, *Claytonia australasica*, *Anisotome filifolia*, *Epilobium tasmanicum*, *Stellaria gracilenta*, *Celmisia discolor*. More local, but frequent, are *Carmichaelia Monroi*, *Corallospartuim crassicaule*, *Myosotis Traversii*, *Craspedia uniflora* var.

Shallow hollows are usually bare, except for scattered small cushions of *Agrostis muscosa* and marginal *Carex Wakatipu*. Where streams occur *Claytonia australasica* forms dense, luxuriant patches. Here too may be small stretches of *Schoenus pauciflorus* or *Hypolepis Millefolium*, and in the water great mats of *Epilobium macropus* and *Montia fontana*.

The association merges below into the induced fell-field caused by the burning of the tussock-grassland, which may be recognized by the presence of several grassland species not found in the true fell-field, *e.g.* *Raoulia subsericea*, *Carex breviculmis*. Above it merges into the association next described. On the southern slopes the association is much closer and grades into the herb-field. It here looks, at a little distance, like tall tussock-grassland, owing to the luxuriant growth of *Celmisia Lyallii*, although *Danthonia flavescens* may be almost absent from wide stretches.

(*c.*) *CELMISIA VISCOSA* ASSOCIATION.

On the wind-swept slopes of Middle Peel, especially on its flattened summit, where snow lies long and drainage is poor, there occurs an open association in which the great mats of *Celmisia viscosa* predominate. *Dracophyllum rosmarinifolium* is plentiful, and in places subdominant. On the bare ground between these are the small tufts and cushions of *Agrostis subulata, Poa Colensoi, Luzula pumila, Luzula Cheesemanii, Anisotome aromatica* var., *Aciphylla Monroi* var., *Drapetes Dieffenbachii, Phyllachne Colensoi, Gentiana corymbifera* (stunted), *Pygmea pulvinaris, Helichrysum grandiflorum, Celmisia discolor, C. Haastii, C. laricifolia.* The cushions and mats are often undermined and dissected by the wind.

The numerous shallow hollows have usually a mossy centre with *Carex Wakatipu, Luzula campestris* vars., and often abundance of *Celmisia Haastii* surrounding it. Other hollows are quite bare. Where drainage is freer *Celmisia Haastii* is especially abundant, *C. discolor* becomes luxuriant, and *Phyllachne Colensoi* forms large, vivid green cushions. Here too may be occasional *Poa caespitosa, Danthonia flavescens* and *Celmisia incana* var.

(*d.*) *POA COLENSOI* ASSOCIATION.

Poa Colensoi, a more or less frequent member of both fell-field and herb-field sometimes produces an induced association where fire has been able to run through the original cover. *Celmisia Lyallii,* flourishing in the most rigorous situations, cannot long, however, withstand fire, and yields place to the fire-resisting *Poa Colensoi. Danthonia flavescens* becomes small and decadent, while *Gnaphalium Mackayi* forms large, low mats, as does to a less extent *Raoulia subsericea.* Between the *Poa* tussocks *Acaena Sanguisorbae* var. *pilosa* and *Celmisia spectabilis* are common. Other plants present in this community are *Festuca novae-zealandiae, Danthonia setifolia, Plantago Brownii, P. lanigera.* Exotics are very rare in this association, but there may be in places a little dwarfed **Rumex Acetosella.* The association occurs at about 1500 m. altitude.

D. THE HERB-FIELD.

True herb-field is developed to only a small extent at Mount Peel, although on the southern faces of the subalpine belt there is much *Celmisia Lyallii* fell-field which approximates to, and in favourable places—sheltered, gentle, rather shaded slopes—merges into the herb-field now described. *Celmisia Lyallii* is in general dominant, and is always of physiognomic importance. The following fell-field plants are abundant: *Lycopodium fastigiatum, Poa Colensoi, Carex Wakatipu, Luzula campestris* vars., *Anisotome aromatica* vars., *Gentiana corymbifera, Celmisia Haastii, C. viscosa.* Common are *Danthonia flavescens, Viola Cunninghamii, Drapetes Dieffenbachii, Epilobium tasmanicum, Celmisia discolor.* The other members of the fell-field are infrequent or absent.

In addition to the fell-field plants we find *Lycopodium Selago, Poa Kirkii, Schoenus pauciflorus, Uncinia compacta, Oreobolus pecti-*

natus, Ranunculus Enysii, R. gracilipes, R. Monroi forma *dentatus, Gentiana bellidifolia, Geum parviflorum, G. leiospermum, Hydrocotyle novae-zelandiae* var. *montana, Gaultheria depressa, Myosotis pygmaea, Ourisia caespitosa, Euphrasia Monroi, E. Laingii, Plantago Brownii, Coprosma repens, Lobelia linnaeoides, Nertera depressa, Forstera Bidwillii, F. tenella, Senecio bellidioides, Celmisia sessiliflora.* The association is thus characterized by its closed nature, the variety and individual abundance of its herbs, and the infrequence of woody plants. On its lower margins it usually merges into a *Hebe* shrubland. Beyond a rare example of **Rumex Acetosella* and **Hypochaeris radicata* in barish patches caused by small slips, exotic plants are absent.

In the flushed ground above stream sources *Celmisia Haastii* assumes a local dominance, giving a greyish green tint to the whole slope. Streamsides are much richer in plants than those of the fell-field. Here to be found are *Schoenus pauciflorus* in quantity, *Scirpus aucklandicus, Carex Raoulii, Poa imbecilla, Cardamine heterophylla* var., *Oxalis lactea, Ranunculus Monroi, Schizeleima hydrocotyloides, Senecio Lyallii* vars., and in the water abundance of *Epilobium macropus* and *Montia fontana.* On gravelly margins are *Claytonia australasica, Raoulia tenuicaulis, Epilobium pedunculare* var., *Ourisia caespitosa.*

E. THE SHINGLE-SLIPS.

There are a few moderate sized shingle-slips on the slopes of Middle Peel facing south-west. On the coarse, moving rubble of the upper portions at some 1500 m. there are scattered about *Poa sclerophylla, Ranunculus Haastii,* and less frequently *Cotula atrata.* A little lower, especially where the débris is finer, occur *Epilobium pycnostachyum, Anisotome filifolia, Myosotis Traversii, Acaena glabra, Craspedia alpina.* On the semi-stable margins there are many small tussocks of *Poa Colensoi,* and as these increase in number the surface becomes sufficiently stable for other fell-field plants to gain root-hold.

Rocks jutting up through the shingle-slips have the usual rock-plants of this altitude, and if large give an opportunity for oases of fell-field on their lower margins. Here may be found large low cushions of *Leucogenes Leontopodium,* sometimes with tuft-plants established on them. Where such a spot is damp through ooze *Schoenus pauciflorus* may be present in quantity, usually associated with *Lycopodium fastigiatum, Ourisia caespitosa, Forstera Bidwillii, Coprosma repens.*

F. THE RIVER-BED.

The portion of the bed of the Rangitata River in the area under examination, some 12 km. long, is characteristic of the larger rivers crossing the Canterbury Plain, with its swift, anastomosing streams, and its wide stretches of large boulders margined by flood plains, and backed by steep terraces some 30 m. high. The successions from bare river-bed by way of an open community of *Raouliae* and *Epilobiae* to *Discaria toumatou* shrubland, *Coprosma* shrubland, or low tussock-grassland, are the same in essentials as those described in the papers of Cockayne (1911), Cockayne and Foweraker (1916, p. 175), and

Foweraker (1917). It does not, then, seem necessary to make detailed references to the phenomena at Mount Peel. Certain matters concerning exotic species are dealt with in a later section.

Worthy of note is the absence or extreme rarity of *Helichrysum depressum*, the rarity of *Coprosma Petriei*, *Carmichaelia nana*, *Coriaria lurida*, and the comparative infrequence of *Raoulia Monroi*, and *R. lutescens.*

G. THE SWAMPS.

(*a.*) GENERAL.

Swampland is not much in evidence in our area, and such swamps as occur are mainly indigenous-induced communities, though there are some apparently modified examples of long-esixting swamps in the grassland associations. There are also numerous small swampy areas along slow-flowing streams through the flood-plain of the Rangitata. Where these streams widen into still ponds the water surface shows *Azolla rubra*, *Lemna minor*, *Myriophyllum propinquum* var., *Potamogeton Cheesemanii*, **Ranunculus aquatilis*. On the margins there is usually a girdle of *Eleocharis acuta*, followed in the shallower water by *Carex ternaria* and *Juncus lampocarpus*, and then *Carex Gaudichaudiana* with *Epilobium Billardieranum* var. The main swamps are of two types, leaving out the swamp forest and the *Leptospermum* swamp already described.

(*b.*) *CAREX SECTA* SWAMP.

The *Carex secta* swamps studied are mainly indigenous-induced communities after the removal of forest, and in process of returning to forest. The large, trunked tussocks of the *Carex*, with immense mop-like heads, which often touch across the intervening water, are very striking. On these heads is often a good deal of *Hierochloe redolens* as a tuft plant, and sometimes stunted *Blechnum capense*, *Pteridum esculentum*, and luxuriant *Hydrocotyle novae-zelandiae* var. On the water there is much *Azolla rubra*, here of a sage-green colour owing to the shade of the tussocks. Also common are *Ranunculus rivularis*, *Epilobium pallidiflorum*, *E. chionanthum*, *E. insulare*, **Mimulus moschatus*. Where the tussocks are farther apart are sheets of *Eleocharis acuta*, and in the deeper water *Potamogeton Cheesemanii*. Towards the margins will be much *Carex ternaria*, *C. Gaudichaudiana*, *C. Oederi* var. *cataractae*, and as the grassland is neared **Holcus lanatus*, **Agrostis vulgaris*, *Potentilla anserina* var. *anserinoides*, and other damp-ground plants, *e.g. Epilobium nerterioides*, *Chrysobactron Hookeri* var. *angustifolia*, *Pratia angulata*, *Mazus radicans*, with the exotics **Rumex crispus*, **R. obtusifolius*, **Prunella vulgaris*, **Myosotis caespitosa*.

The incoming of shrubs, and the development towards Podocarp forest has already been described. Where, however, cattle have access to the swamps, the ground between the outlying tussocks becomes consolidated and dried; **Holcus lanatus* and **Agrostis vulgaris* increase markedly and form hummocks, while **Trifolium repens* often becomes important. The tussocks of *Carex secta* then die out, as they do after drainage of swamp, and a weedy grass results.

(c.) *SCHOENUS PAUCIFLORUS* SWAMP.

This community occurs where streams widen out into many channels on the flood plains, and is now much modified, and owing to stock approximates to bog. The few examples still retaining a truly swamp facies are similar in species, other than the dominants, to those of *Carex secta* swamp, and the transition to grassland is similar. A noticeable feature is the large amount of *Olearia lineata,* small in the swamps, and reaching a height of about 3 m. on the margins. The green-stemmed variety of *Schoenus pauciflorus,* though infrequent, is more often met with in the swamp, than in the bogs later described. How far the *Schoenus* is a true swamp plant, and how far an indicator that bog conditions are approaching my observations are insufficient to pronounce, but the *Schoenus* seems perfectly at home under true swamp conditions.

H. THE BOGS.

True bog is little developed at Mount Peel, although there are numerous boggy patches, already referred to, in the low and tall tussock-grassland, and in fell- and herb-field. There are some small patches of *Schoenus pauciflorus* bog in the montane grassland, conspicuous owing to the brownish-grey tint of the dominant plant, which form a close cover of tussocks. Associated with the *Schoenus* are *Sphagnum* sp., now present only in small amounts and in a depauperated condition, *Oreobolus pectinatus, Carex stellulata, C. Gaudichaudiana,* small *Hierochloe redolens, Chrysobactron Hookeri* var. *angustifolia, Luzula campestris* var., *Halorrhagis micrantha, Viola Cunninghamii, Nertera depressa, Pratia angulata, Drosera Arcturi, Anisotome aromatica* var., *Microtis unifolia, Prasophyllum Colensoi, Celmisia gracilenta,* and less commonly *Blechnum penna marina, Utricularia monanthos, Mazus radicans, Plantago triandra, Aciphylla squarrosa, Olearia virgata* var.

I. THE ROCK COMMUNITIES.

(a.) VEGETATION OF THE UPPER SUBALPINE ROCKS.

The rock-plants of the lower belts have already been dealt with. There remains the distinctive vegetation of the rocks of the highest peaks. The great masses of jagged rocks at the summit of Big Mount Peel at about 1700 m. have in the crevices exposed to the most rigorous conditions of wind and sun the following species of common occurrence: *Danthonia setifolia, Agrostis subulata, Poa Colensoi, Colobanthus acicularis, Exocarpus Bidwillii, Dracophyllum rosmarinifolium, Hebe Cheesemanii, Raoulia eximia, Leucogenes grandiceps, Celmisia incana* var. Less common are *Trisetum subspicatum, Wahlenbergia albo-marginata* (with thick succulent leaves), *Hebe amplexicaulis, Coprosma* sp. aff. *propinqua, Pimelea Traversii.*

The large fissured blocks at the bases of the rocks are characterized by dense rounded masses of *Dracophyllum uniflorum,* cushions of *Hymenanthera dentata* var. *alpina,* and occasional *Aciphylla Colensoi.* The damper, more shaded, and less exposed crevices contain more soil and have *Polypodium pumilum, Poa imbecilla var., Marsippospermum gracile, Cardamine depressa, Ranunculus Monroi* forma

dentatus (very small, and shaggy with *ferruginous tomentum*), *Anisotome aromatica*, *Epilobium tasmanicum*, *Aciphylla Monroi* (much more luxuriant than in the open fell-field), and *Leucogenes Leontopodium*. *Polystichum cystotegia* is a member at rather lower elevations, where other species, *e.g.* *Celmisia discolor*, *Myosotis australis*, show a transition to the rocks already described.

(b.) GENERAL COMPOSITION AND GROWTH-FORMS.

Taking the area as a whole the plants found on rocks may be grouped as follows: plants of wet rocks 46, including 11 pteridophytes, 10 monocotyledons, 25 dicotyledons; plants of dry rocks 69, including 11 pteridophytes, 10 monocotyledons, 48 dicotyledons; plants apparently indifferent as to wetness or dryness 15, including 2 pteridophytes, 1 monocotyledon, 12 dicotyledons. There are 15 species of Polypodiaceae, 13 of Gramineae, 9 of Scrophulariaceae, 15 of Compositae.

Of the 130 species 1 is a small, tuberous-rooted summer-green herb; 14 are simple rosette plants. 45 are tuft plants, including 12 ferns, 16 grasslike tufts or tussocks; 1 is a woody, trailing plant; 4 are woody lianes capable of forming mounded masses in the open; 33 are creeping plants, including 12 mat-forming plants; 32 are bushy plants, including 5 cushion or semi-cushion plants. They may be grouped as herbaceous 69, semi-woody 18, woody 43.

Of the 130 species allowed as true rock-plants 83% are found in other stations, but comparatively infrequently. A number of species not included may occasionally be found on rocks, where *e.g.* the crevices are wide, deep, and contain much soil. The plants that are entirely confined to rocks at Mount Peel, as far as my observations go, are *Cheilanthes Sieberi*, *Asplenium Richardi*, *Polypodium pumilum*, *Polystichum cystotegia*, *Colobanthus acicularis*, *Cardamine depressa*, *Angelica montana*, *Pimelea Traversii*, *Hebe Cheesemanii*, *Hebe amplexicaulis*, *Hebe Allanii*, *Veronica Lyallii*, *Veronica linifolia*, *Raoulia eximia*, *Leucogenes grandiceps*, *Helichrysum Selago*. Almost entirely so is *Hymenophyllum pulcherrimum*.

J. THE EXOTIC PLANTS.

(a.) GENERAL.

Thanks to the work of Cockayne the very prevalent misstatements in biological literature as to the powerlessness of the indigenous species to hold their own in competition with exotic species have been sufficiently refuted, and the true position has been clearly stated. Reference may especially be made to his remarks in Section 5 of *The Vegetation of New Zealand* (1921, p. 280 *et seq.*), and it will suffice to say here that my observations at Mount Peel completely support his contentions. One or two matters may, however, be referred to. My list includes 143 species, but it should be stated that the gardens and waste-places near the village were not searchingly examined, and doubtless contain a number of species not noted, but these are of no moment from the point of view of the present paper. Of the 143 species, 35 are either rare or very infrequent; 23 are practically confined to cultivated land; 22 are confined to road-sides, hedgerows, and

waste places near the village; 9 have been intentionally sown; 9 are found as weeds of the artificial pastures; 10 are found in running water; 3 are found on swamp-margins where cattle run; 12 colonize débris slopes in the low tussock-grassland, and the open riverbed; 20 occur in the much-modified parts of the tussock-grassland. Species that play any significant part in the various indigenous associations have been mentioned when discussing these. There are 23 species of Gramineae, 16 of Compositae, 14 of Leguminosae, 13 of Caryophyllaceae, 10 of Scrophulariaceae, 9 of Rosaceae. The 143 species represent 99 genera and 35 families, and include 58 annuals.

(*b*.) Exotic-induced Communities.

1. *Ulex europaeus *Thicket of the Riverbed.*

This association now occupies very large areas on the riverbed of the Rangitata, and completely overshadows the remnants of the indigenous *Discaria toumatou* thicket. It must, however, be emphasized that this development occurs only on the main river-bed where water-supply from beneath is considerable. On the small shingle-fans where the mountain streams debouch on to the terraces, and on the smaller stream-beds incised in these terraces the conditions are much more xerophytic. The layer of shingle before water is reached is much thicker, and the volume of water very much less. Here **Ulex europaeus* is quite subordinate in amount, and occurs but rarely in the initial stages. *Discaria toumatou* thicket or mixed *Coprosma* shrubland are still the marked physiognomic features of these situations.

There is said to have been no *Ulex* on the Rangitata riverbed prior to 1873, about which time the plant was freely used for hedges. The account here given refers to the present state of affairs. On the recently vacated bed, for the most part covered with large boulders, odd plants of **Ulex europaeus* and **Cytisus scoparius* have established themselves. Between these are occasional small plants of any of **Holcus lanatus*, **Agrostis vulgaris*, *Poa Lindsayi*, **Aira caryophyllea*, **Festuca bromoides*, *Muehlenbeckia axillaris*, **Trifolium repens*, *Epilobium microphyllum*, *E. pedunculare* var., **Hypochaeris radicata*, *Gnaphalium luteoalbum*, *Raoulia australis*, *R. tenuicaulis*, and more rarely several other species. When floods occur patches of silt form round the *Ulex*, and on these patches **Agrostis vulgaris*, **Rumex Acetosella*, **Trifolium repens*, *Acaena microphylla*, *A. inermis* form a turf. The small mats of *Muehlenbeckia* and *Raoulia* also collect silt and extend their borders, forming a seed-bed for various species, including *Poa caespitosa*. Usually the *Ulex* grows rapidly, seeds profusely, and forms dense patches that coalesce to form thickets under which the other plants become decadent. Successive floods increase the depth of the silt and completely bury the boulders. At this stage **Holcus lanatus* and **Anthoxanthum odoratum* are almost the only survivors below the *Ulex*.

Such thickets are often burnt and the sandy surface exposed. *Ulex* regenerates from the base and may be cropped by rabbits and sheep to a dense cushion form. The bare sand becomes occupied by **Holcus lanatus*, **Rumex Acetosella*, *Oxalis corniculata* (often very abun-

dant), and a brown moss. Here too *Raoulia lutescens,* uncommon on the original riverbed, is often quite frequent. In places *Triodia exigua, *Poa pratensis, *Agrostis vulgaris, *Trifolium repens* greatly assist in forming a turf. Such an area if stocked with sheep and the rabbits kept in subjection becomes an exotic-induced grassland that is invaded by *Poa caespitosa* and *Festuca novae-zealandiae* which produce a grassland very similar to the modified low tussock-grassland of the terraces. If the *Ulex* is not kept down it soon re-establishes a thicket.

2. *Ulex europaeus *Thicket of the Hillside.*

Great thickets of *Ulex* form a striking feature of certain hill-slopes on the Rangitata face. A similar thicket of **Cytisus scoparius* occurs on one slope in the montane tussock-grassland.

Some fifty years ago a **Ulex europaeus* hedge of the "bank and ditch" type was constructed from one gully forest to another across a "saddle" at 500 m. altitude. The hedge was on a sunny slope facing the east and ran through the *Blechnum capense* belt and the lower tall tussock-grassland. From this hedge have developed the thickets now found, which are still extending their margins. Burning and cutting have been attempted from time to time, but never in a wholesale manner, and sufficient *Ulex* has always been left to reseed the burnt areas under more favourable conditions than before, while regeneration from the burnt stumps has been abundant. Over a considerable portion of the infested area the original associations have been obliterated. Towards the margins the course of the struggle may still be followed. The seedling *Ulex* grows rapidly, shading the herbaceous plants, which become drawn up and etiolated, and gradually succumb. *Danthonia flavescens, Phormium Colensoi, Aciphylla Colensoi,* and various shrubs, persist longer, but are killed out by the burning so that finally there is an almost pure *Ulex* association. In places, however, **Holcus lanatus* and **Anthoxanthum odoratum* are plentiful, with distant-noded culms stretching up through the bushes.

Where burning has been unusually severe on dry, sunny slopes *Pteridium esculentum,* may occur plentifully and even dominate the *Ulex.*

A noteworthy feature is the ready downward migration of the **Ulex,* and the much slower upward movement. Above an altitude of some 550 m. *Ulex* loses its aggressive powers and is represented by odd stunted bushes, and above 600 m. is hardly to be found at all.

K. FLORISTIC NOTES.

It does not seem necessary to provide a complete list of species noted, but as, in general, only the commoner species have been mentioned in the body of the paper, attention may be drawn to the presence of certain of the rarer species. Of species previously recorded for Mount Peel I have failed to discover *Veronica anomala,* which is mentioned by Cheeseman in the *Manual* ed. 1 (1906), p. 523) on the authority of Armstrong. I have, however, observed certain narrow-leaved forms of *Hebe buxifolia* that, as Cheeseman remarks, approach *Veronica anomala* somewhat closely.

The species noted by me may be tabulated as follows:

	Families.	Genera.	Species.
Pteridophyta	9	26	61
Gymnospermae	2	2	4
Monocotyledones	9	42	104
Dicotyledones	52	120	317
	72	190	486

There are 33 species of Polypodiaceae, 40 of Gramineae, 31 of Cyperaceae, 27 of Onagraceae, 24 of Rubiaceae, 62 of Compositae, while there are 22 families represented by 1 species each. Of genera *Carex* has 18 species, *Epilobium* 24, *Coprosma* 17, *Celmisia* 11.

Attention may be drawn to the presence of: *Gleichenia circinata* var. *hecistophylla*—ridges in hillside forest, very rare; *Cyathea Cunninghamii*—plentiful in one locality in hillside forest; *Libocedrus Bidwillii*—in hillside forest, rare; *Hierochloe Fraseri* var. *recurvata*—upper tall tussock-grassland; *Deyeuxia Youngii* var. *Petriei*—in *Blechnum capense* belt, rare; *Deschampsia tenella*—in lower fell-field, rare; *Poa dipsacea*—in herb-field, rare; *Carex comans* var. *pulchella*—in lower forest; *Luzula Cheesemanii*—in upper fell-field, rather rare; *Astelia Petriei*—in tall tussock-grassland, local; *Korthalsella salicornioides*—on *Leptospermum ericoides*, plentiful in one locality; *Clematis foetida* var.?—a small shrubland plant; *Ranunculus Enysii*—in herb-field, rare; *Pittosporum Colensoi* var.?—a small tree, very distinct from *P. tenuifolium*, and also from northern forms of *P. Colensoi*, not seen in flower or fruit, gully forest, rare; *Carmichaelia flagelliformis*—so named by the late Mr. Petrie, in lower subalpine scrub, rare; *Edwardsia microphylla* × *prostrata*—in débris scrub in one locality, near the Rangitata Gorge; *Epilobium pedunculare* var. *minutiflorum*—along stream beds, infrequent; *Schizeleima hydrocotyloides*—by streams in herb-field, rare; *Angelica decipiens*—in tall tussock-grassland; × *Hebe Kirkii*—river terrace shrubland, very infrequent; *Hebe Cheesemanii* (= *Veronica quadrifaria* of the *Manual*)—Summit rocks, plentiful; *Veronica linifolia*—rocks by streamsides, noted in one locality only; *Euphrasia Laingii*—in herb-field; *Plantago lanigera*—very infrequent; *Coprosma areolata*—forest-margin, rare; *Nertera Cunninghamii*—exactly matching the North-west Nelson plant, noted in one locality only; *Lobelia linnaeoides*—herb-field, infrequent; *Olearia Haastii*—by streams in tussock-grassland, very rare; *Olearia fragrantissima*—Lynn Valley, not common; *Celmisia incana* var.?—a rock-plant near summit, possibly sp. nov., common; *Celmisia coriacea* × *Lyallii*—fell-field, rare; × *Helichrysum Purdiei*—by streamside, Lynn Valley, infrequent; *Cotula pectinata*—fell-field, infrequent.

The new species discovered were *Gaya Allanii*—forest-margins, a few plants noted; *Hebe Allanii*—a rock-plant in tussock-grassland, noted in two localities, and there common.

LITERATURE CITED.

CHEESEMAN, T. F., 1906. *A Manual of the New Zealand Flora*, Wellington.

COCKAYNE, L., 1911. "On the Peopling by Plants of the Subalpine River-bed of the Rakaia (Southern Alps of New Zealand)," *Trans. and Proc. Bot. Soc. Edin.*, vol. 24, p. 104.

COCKAYNE, L., 1921. *Die Vegetation der Erde*, 14, Vegetation of New Zealand. Leipzig.

COCKAYNE, L., and FOWERAKER, C. E., 1916. "Notes from the Canterbury College Mountain Biological Station: No. 4—The Principal Plant Associations in the immediate vicinity of the Station," *Trans. N.Z Inst.*, vol. 48, p. 166.

FOWERAKER, C. E., 1917. "Notes from the Canterbury Mountain Biological Station, Cass: No. 5—The Mat-plants, Cushion-plants, and Allied Forms of the Cass River-bed (Eastern Botanical District, New Zealand)." *Trans. N.Z. Inst.*, vol. 49, p. 1.

Botanical Notes, with Descriptions of New Species.

By H. CARSE.

[*Read before the Auckland Institute, 24th Nov., 1925; received by the Editor 28th November, 1925; issued separately, 13th November, 1926.*]

1. **Lycopodium australianum** Nerter n. sp.

Engler's Bot. Yahrb. 43, Bernh. No. 98, p. 42.

According to Dr. Carl Christensen the above is the correct name for the plant we have hitherto known as *L. Selago*. He says, "Some years ago Dr. Nerter, Berlin, split up the old *Selago* into a number of species, and he refers your form to *L. australianum* Nerter, n. sp. Reflexed leaves are rarely seen in our European and Arctic forms."

In New Zealand forms reflexed leaves are very noticeable, especially in the more robust shade forms.

2. **Eleocharis acuta** R. Br.

var. *tenuis* Carse var. nov.

A typo differt culmis spiculisque tenuioribus. Culmi 17-37 cm. longi, spiculae 5-12 mm. longae, 2 mm. latae, acutae.

This variety differs from the type in the more slender and usually much shorter culms, and markedly in the more slender, acute spikelets.

Culms 5-13 in. long; spikelets $\frac{3}{8}$-$\frac{1}{2}$ in. long, narrow, acute.

This form has been confused with *E. Cunninghamii*, but is at once distinguished by the "sheath closely oppressed to the stem, with a horizontally truncate mouth, the margin of which is thickened and usually dark-coloured with a small, erect mucro or rudimentary lamina on one side." (Cheeseman, *Manual of the N.Z. Flora* ed. 2 (1925) 217) and by the much longer and narrower spikelets.

3. **Scirpus fluitans** (R. Br.) L.

"Stem floating, 6-18 in., compressed, slender, branched. Leaves 1-2 in., linear, very slender. Spikelets terminal, solitary $\frac{1}{8}$-$\frac{1}{6}$ in., nar-

row-ovoid, pale. Glumes 4-8 oblong. Stigmas 2. Fruit plano-convex pale, smooth, tipped with the base of the style." *The Students' Flora of the The British Isles.* J. D. Hooker, p. 400.

var. *productus.* (C. B. Clarke) Kuekenthal.

"Kuekenthal's description of the var. *productus* is not available. The previous determination was based on specimens which had been sent to Kuekenthal, and which were determined by him as the var. *productus.* Apparently Kuekenthal reduced *Scirpus productus,* C. B. Clarke to varietal rank. A description of this species is as follows:

Culmis polynodis, elongatis, foliatis; pedunculis solitariis monostachyis; spicula 5-6 mm. longa; gluma ima angustata, atro-castanea, saepe bracteiforma cum spicula aequilonga; setis 0; stylo 2-fido.

Clarke regards his species as synonymous with *Isolepis fluitans* var. β (Hook. f. *Fl. Tasm.* II, p. 86), which is described as "spicules and leaf-sheaths dark-chestnut." R. H. Anderson, B.Sc., National Herbarium, Sydney.

For many years this species and its variety have been regarded by New Zealand botanists as forms of the nearly allied species *Scirpus lenticularis* (R. Br.) Poir., a much more robust plant.

Hab., North Island: Waimarino Plain, D. Petrie! H. B. Matthews! H. Carse, var. *productus.* Lake Tangonge, Kaitaia, (Mangonui Co) R. H. Matthews! H. B. Matthews! H. Carse.

It is more than probable that this plant occurs in still water in many other parts of the Dominion, but as it is almost entirely submerged it is easily overlooked.

4. **Schoenus fluitans** Hook. f.

"A very singular plant, in habit unlike its congeners and resembling *Isolepis fluitans* very closely.

"Culms densely tufted rooting at the base in gravel, the main part floating, 2 ft. long, very flaccid and much branched. Leaves narrow linear with membranous sheaths and an evident ligule. Spikelets solitary, terminal, bright pale chestnut, shining, linear, narrow, nearly ½ in. long, much compressed, two-flowered. Scales membranous, not nerved, lower shorter, all linear-lanceolate, sub-acute. Nut pale brown, small, smooth, with a very long persistent style from which the 3 stigmas fall away. Filaments capillary, brown, persistent." *Flora Tasmaniae,* p. 81. J. D. Hooker.

This species is now for the first time recorded as indigenous in New Zealand. Mr. L. Rodway, of Hobart, Government Botanist, who kindly compared my specimens with the type, says, "I have examined your specimens of *Schoenus fluitans.* I have not noted any features which indicate a distinction from the form common to Tasmania."

The culms of my specimens vary considerably in length according to the depth of the water in which they grow, 6 in. to 3 ft. being the extremes.

Hab., North Island: In running water in various parts of Waimarino Plain. H. B. Matthews!, H. Carse.

It is probable that this species occurs in other parts of New Zealand. It is easily overlooked, as the leaves are usually of a bronzy tinge not readily perceived in the brownish peat water, and only the flowering tips emerge.

5. × **Cordyline Matthewsii** Carse nov. hybr.

Planta *C. australi* et *C. pumilioni* accedens. Caules 1-3 m. longi, 1.5-4 mm. diam. numerosi ab rhizoma communi adscendentes, vel solitarii, procumbentes. Folia apices ramorum versus conferta 3-9 dm. longa, 1-2 cm. lata, anguste linearia, acuminata, coriacea; nervis evidentibus, parallelis, numerosis, plerumque 20-50, Costis prominentibus. Foliorum bases vaginantes, latae ut in *C. australe*, vel angustae ut in *C. pumilione*. Paniculae terminales, multiramosae, 1 m. longae. Flores in ramis panicularum distantes ut in *C. pumilione* vel densi ut in *C. australi*. Baccae illis *C. pumilionis* similes, sed majores.

A plant akin to *C. australis* and *C. pumilo*. Stems 1-3 m. long, 1.5-4 mm. diam., numerous, ascending from a common rhizome, or solitary procumbent, ascending at the apex. Leaves crowded at the ends of the stems, 3-9 dm. long, 1-2 cm. wide, narrow-linear, acuminate, coriaceous, nerves numerous, 20-50, evident, parallel, midribs, prominent, sheathing bases wide as in *C. australis*, or narrow as in *C. pumilio*. Panicle terminal. Much branched, 1 m. long. Flowers distant on the branches of the panicle as in *C. pumilio* or more crowded as in *C. australis*. Berries rather larger than in *C. pumilio*.

Hab., North Island: Oinu Bush, Kaitaia, H. B. Matthews!; Otukai and Kopu Okai, near Kaiaka, H. Carse. (All in Mangonui County).

I have little doubt that this plant, which I have much pleasure in dedicating to Mr. Matthews, its discoverer, is a hybrid between *C. australis* and *C. pumilo*. Some forms are almost enlarged replicas of the latter, while more robust forms have the broad sheathing bases of the leaves as in the former plant.

6. **Astelia nana** Carse sp. nov.

Herba parva epiphytica. Folia pauca, 8-30 cm. longa, 5-10 mm. lata, anguste linearia, inferne attenuata deinde in bases vaginantes expansa, squamis innumerosis, iridescentibus, utrinque vestita; nervi numerosissimi; costa prominens, nervo valde distincto ex lateribus. Scapus simplex, gracilis, tomento fulvo vestitus, 2.5-11 cm. longus; pars fertilis 1.5-3 cm. longa; ± 10 floribus induta. Flores ♂ 5 mm. longi, suffusco-virides; perianthi segmenta lanceolata, patentes, 3 exteriora interioribus longiora. Flores ♀ multo minores. Ovarium globose-ovoideum, stigma longa; baccae globosae, suffuscae 4 mm. diam.

A small tufted epiphyte. Leaves few 8-30 cm. long, 5-10 mm. wide at middle, narrow-linear, tapering to a fine point, narrowed below then expanding into a broad sheathing base, above covered with innumerable minute iridescent scales, below with a silvery pellicle intermixed with similar scales; nerves very numerous, midrib and one on either side of it being more prominent, base of sheath clothed with dense pure white silky hairs. Scape slender, unbranched, densely clothed with fulvous silky hairs, as are the leafy bracts, 2.5-11 cm. to the lowest flower, flowering part 1.5-3 cm. long, ± 10 flowered. Male flowers 5 mm. long, brownish-green, perianth segments lanceolate, spreading, outer three longer than the inner ones, downy on outer surface. Stamens shorter than the segments, anthers oblong. Female flowers much smaller. Ovary ovoid-globose, stigma long for size of ovary, berry globose, yellowish-brown, 4 mm. diam.

Hab., North Island: On trunks of trees, Kaiaka (Mangonui Co); Maungatapere (Whangarei Co); Mauku (Franklin Co), H. Carse.

I first noticed this small *Astelia* over a quarter of a century ago, but for a considerable time had only male flowers. The plant is not uncommon but appears very shy of flowering. The late T. F. Cheeseman writing, of it said, "This is very puzzling; I have never seen so small a specimen in flower, and the leaves look very different to any of the recognised species."

7. **Nasturtium Wallii** Carse sp. nov.

Herba *N. fastigiato* affinis. Radix fusiformis, longa, robusta; caulis brevissimus. Folia numerosa, radicalia, rosaceo-congesta, coriacea, glabra, lanceolato-spathulata, obtusa, 3.5-17 cm. longa, laminis 2.5-5 cm. longis, 1-2.5 cm. latis, 4-lobatis fere ad costam, lobis obtusis paulo mucronatis. Petioli lati, plani. Folia caulina desunt. Scapi soltarii, simplices, 15-30 cm. alti. Flores numerosi, corymbosi, albi, 10 mm. diam.; petala 10 mm. longa, spathulata, unguibus longis. Siliquae erectae vel incurvatae, utrinque acutae, anguste lineares, 2.5-5 cm. longae, 3 mm. latae. Semina compressa fusco-rubra.

This plant is allied to *N. fastigiatum*, from which it is at once distinguished by the larger, more deeply lobed radical leaves and the absence of cauline leaves. Rootstock long, stout, tapering, surmounted by a dense mass of rosulate radical leaves. Leaves 1½-7 in. long, lanceolate-spathulate; blade 1-2 in. long, ½-1 in. wide, 4-lobed nearly to the midrib, lobes obtuse, slightly mucronate, narrowed into the broad flat petiole, coriaceous, glabrous; cauline leaves absent. Flowering stems solitary, simple, 6-12 in. high. Flowers numerous, corymbose, white, $^2/_5$ in. diam., petals $^2/_5$ in. long, spathulate on long claws; pods erect or incurved, acute at either end, narrow-linear, 1-2 in. long, $^1/_{12}$ in. wide. Seeds compressed, brownish-red.

Hab., South Island: Cecil Peaks, Lake Wakatipu at 4000-5000 ft. elevation. A. Wall!

8. × **Metrosideros sub-tomentosa** Carse nov. hybr.

Arbor *M. robustae* et *M. tomentosae* accedens, 4.5-9 m. alta. Truncus brevis, robustus, 5 dm. diam., ramis patulis. Folia decussata, 2.5-5 cm. longa, anguste, elliptica sub-acuta vel sub-acuminata, basim versus angustata, vel elliptico-oblonga, rotundata retusaque, basim versus rotundata. Venae ut in *M. robusta*. Flores illis *M. robustae* vel *M. tomentosae* similes. Pedunculi, calycesque glabrescentes vel leviter-tomentosae.

A much-branched shrub or tree 15-30 ft. high, with a short, stout trunk, 2 ft. diam. Leaves decussate 1-2 in. long, narrow-elliptic, subacute, or sub-acuminate, acute at the base, or elliptic-oblong, retuse, rounded at both ends. Venation as in *M. robusta*. Flowers dark-crimson in many flowered terminal cymes, peduncles and pedicels less stout than in *M. tomentosa* with the calyces less tomentose. Calyx tubes and capsules varying in size. Some identical with those of *M. robusta*, others almost equalling those of *M. tomentosa*.

Hab., North Island: Lake Taupo, H. Hill (per D. Petrie)! Bank of Whau (tidal creek); Titirangi, (both near Auckland), H. Carse.

The Lake Taupo plant is nearer to *M. robusta* and the Whau Creek plant to *M. tomentosa.* In all the forms the vein running parallel with the margin of the leaf, a character of *M. robusta,* is well marked.

9. **Coprosma viridis** Carse sp. nov.

Frutex multiramosa, ramulis arrectis, 1.5-2 m. alta. Ramuli tenues, glabri, cortice rubro-fusco. Folia 10-20 mm. longa, pallido-virides apicibus ramulorum lateralium brevium fasciculata, in petiolos breves, glabros, contracta. Stipuli late triangulares, apiculati, ciliolati. Flores ♂ non visi. Flores ♀ numerosi, in foliarum axillis positi; calyx 5-dentatus; corolla anguste campanulata, 5-lobata, segmentis obtusis; styli breves. Drupi aggregati, oblongi, 3-6 mm. diam., sanguinei, nitidi.

A much and virgately branched shrub 4-6 ft. high, branched, slender, glabrous, bark reddish-brown. Leaves 10-20 mm. long, chiefly crowded at the ends of arrested branchlets, pale-green ovate, minutely apiculate, narrowed into a short glabrous petiole, rather coriaceous, margins slightly thickened, usually reddish. Veins closely anastomising. Stipules broadly triangular, apiculate, minutely ciliate when young. Male flowers not seen. Female flowers abundant, on the branches in the axils of fallen leaves, below the crowded leaves. Calyx limb minutely 5-toothed; corolla narrowly campanulate, 5-lobed, segments obtuse. Styles short. Drupes crowded, oblong $\frac{1}{8}$-$\frac{1}{4}$ in. long, blood-red, shining.

Hab., North Island: Coastal rocks, Whangaroa Harbour, H.C.

This is a very striking and distinct-looking plant. Its pale-green leaves, which retain their colour when dry, and its clusters of blood-red drupes below the masses of terminal leaves make it a conspicuous object. I am indebted to Mr. W. A. Thomson, of Dunedin, to whom I sent seeds some years ago, for specimens showing female flowers.

I gladly record my thanks for assistance, information, and specimens to the following gentlemen: Dr. Carl Christensen, of Copenhagen; The Director of the Botanical Gardens, Sydney; Mr. R. H. Anderson, of the National Herbarium, Sydney; The Director of the Tasmanian Museum; Mr. L. Rodway, Government Botanist, Hobart; the late Dr. Petrie, Auckland; Dr. H. H. Allan, Feilding; Mr. H. B. Matthews, Auckland; and Mr. W. A. Thomson, Dunedin.

Some Problems of Distribution of Indigenous Plants in New Zealand.

By A. Wall, M.A., Professor of English, Canterbury College.

[*Read before the Philosophical Institute of Canterbury, 1st April, 1925; received by Editor, 15th June, 1925; issued separately, 17th November, 1926.*]

The student of the flora of New Zealand in its wild state is confronted with very many problems arising out of the distribution of particular species. A certain plant, for example, will be found only in a very restricted area with no nearly related forms in its vicinity; or another will be found most nearly related only to one which grows many hundreds of miles away, both being quite rare; or yet another will be found commonly growing in two or more different localities at a great distance from one another, yet entirely absent in the intervening spaces. An attempt is here made to offer provisional explanations of some of these apparent anomalies.

Geological Background.

In order to consider problems of present-day distribution it is useless to go further back than the great post-Tertiary orogeny to which "and the consequent denudation is due almost all of the present relief of New Zealand, excepting that of the volcanic mountains" (Benson, 1921). At this time the component elements of our flora, the Paleo-zelandic, Antarctic, Malayan and Australian were all present; the surface of the country resultant from the block-faulting must be thought of in early Pleistocene times as "a group of differentially elevated earth-blocks" with high plateaux, "intermontane basins," and narrow rectilinear rift-valleys, subsequently brought to its present state by a long process of denudation and sedimentation. We must think of the early covering-strata of marine origin, once a continuous sheet, as removed by erosion and remaining only here and there in corners and pockets. We must think of the climate attendant upon the Pleistocene elevation, and its extension into Pleistocene time, as "glacial" on the high plateaux and "steppe" or "semi-desert" on the Eastern side of the Southern Alps. We must think of New Zealand as extending, for the last time, far beyond its present limits and including indeed, the Chathams, Auckland, and other outlying Islands. Then we must think of the subsequent depression of the land, the wearing down of the high Alpine plateau to its present form in the Southern Alps, the retreat of the glaciers, and the return of a milder and more pluvial climate.

Following Cockayne (1921) we note during this epoch the rise of the intense xerophytes "by epharmonic change" during the Pleistocene and again at the end of the Pleistocene, as a result of the depression of the land and the great climatic changes, "new forms of plants, descendants of the ancient species acted on by the novel and diverse environments." At this time, thinks this authority, did *Celmisia, Veronica, Epilobium* etc. "burst forth into multiplicity of forms" and this process is not even yet complete.

From this account it is clear that we must regard our present species as resultant partly from mutations as demanded by De Vries (whether such mutations be due to any determinable external cause or not) and partly from "epharmonic variation," the forms responding to the stress of new conditions and becoming modified or adapted into true new species; partly to "reversions"; and partly, according to Dr. Cockayne's latest pronouncements (or even entirely) from hybridisation.

This, in bare outline, is the past history to which we must look for the explanation and elucidation of our modern problems of distribution. It may be necessary, however, in certain cases to appeal to a still more remote past, and here may be mentioned, as offering a solution when all else fails, the theory that in "Oligocene-Miocene" time New Zealand was reduced to a group of small islands, when necessarily many species, especially alpines, must have become extinct "and plastic species, perhaps the sole survivors of large genera, would find a haven of refuge on rock-faces etc." (Cockayne, 1921).

This phrase "plastic species," however, implying as it does inheritable variability, would now, I suppose, be withdrawn by the writer of this passage and replaced by some such words as "aggregates including many microspecies capable of intercrossing."

The natural difficulty of these problems is much increased by the too frequent absence of sufficient data. In the case of lowland species the activities of man have destroyed so much that we can never feel ourselves on firm ground in making inferences about the original distribution of particular species, while on the other hand in the case of alpine species, especially very small forms like the dwarf grasses and Carices, an immense amount of hard observational work must yet be done before we can feel at all certain that we have all the facts. In the writer's own experience it has happened more than once that the chance of his taking a particular line in descending through a high shingle basin has resulted in an extension of the range of a particular species by over a hundred miles. The same is true in a lesser degree of all small plants and all that grow in out-of-the-way or inaccessible situations. A further cause of complication is the destructibility (or the reverse) of the habitat. A rupestral, high alpine, maritime, or bog plant has natural bulwarks and will generally survive (*e.g.*) grazing or burning, when a species of the grassland or shrubland is in danger of extinction. So great a part of the lowland and hill districts of New Zealand has been subjected to these risks that we are often quite unable to say what was the original distribution of a given species.

Attention has been directed in this paper chiefly to species in whose case these disabilities are absent, or as nearly so as possible. We may, for instance, be quite sure of our data in the case of such a conspicuous and famous plant as *Olearia insignis* which is purely rupestral and of very conspicuous and striking appearance; not so sure, but fairly so, in the case of *Celmisia Traversii,* which is alpine and subalpine.

About fifty of the typical cases of difficulty are here tabulated:

A. Species.	B. Locality or Localities.	C. Nearest Affinity or Affinities.	D. Loca y of nity.	E. Geographical Relation of A. to C.
Ranunculus paucifoliu	Castle Hill, Waimakariri	*R. chordorhizos*	Macaul ay R. Mt. Hutt or M Torlesse	Both occur or occurred in Waimakariri District.
Ligusticum flabellatum	Stewart	*L. Enysii*	Canterbury d Otago (ra)	Never occur together.
Angelica trifoliolata	Torlesse and L. Tennyso	*A. decipiens* a *A. gingidiur*	S. Alps	*A. gingidium* } not far away, *A. decipiens* } at Mt. Torlesse.
Olearia insignis	Parts of Marl borough	No near affinit *O. angustifolia* (	S.S. Island and Stewart Island	Never together, nor within 200 miles.
Celmisia rupestris	Mt. Peel, Nels	*C. Walkeri*	Canterbury and Otago Alps	Never together, about 150 miles apart.
C. Gibbsii	Mt. Cobb, Nelso	*C. Walkeri* and *C. rupestris*	As above	*C. rupestris* and *C. Gibbsii* neighbours. *C. Walkeri* not nearer than 150 miles.
C. Traversii	(1) Nelson and Hanmer Al (2) S.W. Otago	*C. spectabilis* and group	Passim.	*C. Traversii* and *C. spectabilis* neighbours.
C. cordatifolia	Nelson Mts.	*C. spectabilis* and group	Passim.	*C. cordatifolia* and *C. spectabilis* neighbours.
C. Rutlandii	Mt. Stoke	*C. petiolata* "allied to *C. petiolata*"	Central and Western Alps	Never together, nor nearer than about 100 miles.
C. Mackaui	Banks	*C. co*	S. Al and passim.	Never together now, Mt. Grey nearest station to *C. Mackaui* about 50 miles.

A. Specie	B. ality or cali..es.	C. Ne rest A inity o A es.		E. Geographical Relation A. to C.
C. Petriei	Otago and Southland, Collingwood?	*C. Lyalli*	S. Alps and passi	Togethe tago
C. McMahoni	Mt. Stokes, Fishtail, and Richmond.	*C. Hecto*	S. Alps from Mt. Cook southwards.	Never together, nor nearer than about 200 miles.
C. parva	Heaphy R. extreme N.W.	*C. Hecto*	S. Alps from Mt. Cook southwards.	Never nearer than 200 miles.
C. vernicosa *C. Campbellensis*	Auckland and Campbell Islands	*C. spectabilis* group (?)	S. Alps, passim.	Affinity only on mainland R. only on outlying Islands.
Raoulia Goyeni	Stewart Island	*R. bryoides*	S. Alps, passim.	Not together on Stewart Id.
Helichrysum coralloides	N.E. District of S. Alps	*H. selago*	S. Alps, passim.	Grow together.
Cotula linearifolia	Wairau	*C. pyrethrifolia*	S. Alps, passim.	Grow as neighbours.
Senecio saxifragoides	Port Hills	*S. lagopus*	S. Alps etc., pas	Grow separately, but as near neighbours.
S. glaucophyllus	Mt. Aruthur	*S. latifolius*	Western S. Alps	Not near neighbours probably.
S. Greyii	S.E. of North Id.	*S. laxifolius*	S. Nelson Alps	Never together or near.
Helichrysum dimorphum	Waimakariri Dist.	*H. depressum*	S. Alps, passim.	Grow together.
Wahlenbergia cartilaginea	N.E. District of South Island	*W. saxicola*	Passim.	Grow near together, bu at different ltitudes.
Logania depressa	Onetapu	*Geniosto*	N. Island	Sole repr sentative of s genus in Ne v Zealand.
Myosotis decora	Castle Hill, Mt. Torlesse	*M. antar tic*	S. Alps etc., passim.	Not very far apart.
Myosotis explanata	W. Canterbury Alps	*M. capitata*	S. Island, cliffs on coast	Never w hin mil of each other.

A. Species.	B. Locality or Localities.	C. Nearest Affinity or Affinities.	D. Locality of Affinity.	E. Geographical Relation of A. to C.
Myosotidium nobile	Chatham Id.	*Myosotis* (?)	Passim.	Stands alone.
Veronica Dieffenbachii	Chathams	*V. speciosa*	N. or N. Island	Nowhere near each other.
V. Barkeri	Chathams	*V. speciosa*	N. or N. Island	Nowhere near each other.
V. anomala	Upper Rangitata	*V. buxifolia*	Passim.	Grow probably near each other.
V. Gibbsii	Mt. Rintoul, etc.	*V. pinguifolia*	Nelson to Otago	Grow together on Ben Nevis, etc.
V. tumida	Nelson Mts.	*V. tetrasticha* and *V. quadrifaria*	Passim, S. Alps	Grows alone.
V. Lavaudiana	Banks Peninsula	*V. Raouli*	Nelson, Canterbury	Grows alone, but *V. Raoulii* grew formerly with it.
V. Hookeriana	Volcanoes	*V. Lyallii*	Passim.	Not together, but not far apart, and at different altitudes.
V. spathulata	Volcanoes			
Scutellaria novae-zelandiae	Nelson	No near affinity		
Muehlenbeckia Astoni	Wellington and S. Id. Coast	*M. australis*	Passim	Grow together.
Poranthera microphylla ***P. alpina***	Nelson Province	*Euphorbia* (?)	Coastal, passim.	Never together.
Uncinia nervosa	Mt. Arthur, Nelson	*U. compacta*	Passim in S. Id.	Probably together or nearly.
Carex pterocarpa	Otago Alps and Canterbury, 4,500-6,500 ft.	*C. Kirkii*	General and Alps to 4,000 ft.	Not far apart but at different altitudes.
C. Hectori	Old Man, Otago	*C. decurtata* *C. uncifolia*	L. Tekapo, S. Alps, passim.	Not together, nor at all near. Not together.

A. Species.	B. Locality or Localities.	C. Nearest Affinity or Affinities.	D. Locality of Affinity.	E. Geographical Relation of A. to C.
C. Dallii	Nelson Mts.	*C. Petriei*	S. Alps, passim.	Not together.
Hierochloe Brunonis	Auckland and Campbell Islands	*H. redolens*	Passim.	Not together in Aucklands, but together in Campbell Id.
Agrostis Petriei	Otago	*A. Dyeri* (?)	S. Alps, passim.	Not together but not far apart.
A. tenella	Otago and Canterbury			
Deschampsia novae-zelandiae	Very scattered localities in S. Island and			
D. Chapmani		*D. caespitosa*	General	Not together.
D. tenella				
D. pusilla				
Danthonia pungens	Stewart Island	*D. australis*	General	Not together.
Poa acicularifolia	Limestone in Nelson and Canterbury	*P. Colensoi*	N. and S. Alps. passim.	Not together, but near neighbours.
P. pygmaea	Otago Alps	*P. Colensoi* (?)	General	
Agropyrum Enysii	Canterbury Alps	*A. scabrum*	General	Close together.

In order of difficulty the possible cases may be thus arranged:

(1) The R (Restricted Distributant) and the A (Affinity) occur together or in fairly close proximity. Thus *Helichrysum coralloides* (R.D.) and *H. selago; Senecio saxifragoides* (R.D.) and *S. lagopus; Celmisia Mackaui* and *C. coriacea* may be placed here (?)

(2) The R and A belong to the same district while generally growing in such different habitats that they rarely or never actually occur together. Thus *Carex pterocarpa* (R.D.) 4,500-6,500 ft.; and *C. Kirkii* to about 4,000 ft.; *Wahlenbergia cartilaginea* and *W. saxicola.*

(3) The R and the A both grow in New Zealand proper but are separated from one another by great distances. Thus *Celmisia McMahoni* (R.D.) and *C. Hectori; Veronica rigidula* and *V. Colensoi* (of the *Manual*).

(4) The R occurs in New Zealand only with no near affinities, or in Stewart Id. or the outlying Islands with affinities only on the mainland of New Zealand. Thus *Poranthera microphylla* and *P. alpina* (R.D.) with no near affinities; *Danthonia pungens* (R.D.) on Stewart Id. and *D. australis* on the mainland; *Celmisia vernicosa* and *C. Campbellensis* (R.D.). This is still more striking in the case of *Pleurophyllum* for no representative of the genus occurs on the mainland.

(5) The genus which includes one species only with no close affinities in New Zealand. Thus *Logania, Xeronema, Tetrachondra, Myosotidium,* and probably *Olearia insignis.*

Of these there are sub-classes or special cases of which a few may be mentioned.

(6) *Celmisia Traversii* generally restricted to parts of the North-east Botanical District, is most nearly related, no doubt, to *C. spectabilis* and its group, as in (1) above, but occurs also in the far South-west. Such apparent anomalies as this may be due to imperfect observation or record, or both, but hardly in the case of so striking a plant as this. This is also the case of *Ranunculus crithmifolius*: affinity, *R. Haastii,* widely distributed.

(7) *Celmisia rupestris* and *C. Gibbsii,* both most closely related to *C. Walkeri,* grow in different parts of the same restricted area (in Nelson Province), from which *C. Walkeri* itself is absent. The case of *C. McMahoni* resembles this, but that species grows on different isolated areas within a single district.

Considering these cases in their order:—

(1) The first offers little or no difficulty. *Helichrysum coralloides* may be considered to have originated, whether by mutation or crossing or by "evolution," from the commoner plant, and its restricted distribution may be set down to its comparatively recent origin. (So far as has been observed it shows no tendency to spread any further, however). This would appear to be the natural or normal procedure of nature; it is to be expected that the older or original species should exist with or not far from the younger; our difficulties begin when this does not occur. The Senecios, *S. saxifragoides* and *S. lagopus,* offer a harder problem, but they are very slightly differentiated from one another. They occupy, each on its own district, conterminous areas, without ever commingling. (Wall, 1918). The case of *Cel-*

misia McKaui confined to Banks Peninsula, while *C. coriacea,* its affinity, is generally distributed, but not found on the peninsula, may be one of the most difficult cases to explain, but we cannot certainly say that *C. coriacea* was never on the Peninsula, so that our data are possibly insufficient. *C. coriacea* is on Mt. Grey about 40 or 50 miles distant. As it tends to be a "fireweed" it seems improbable that it has existed on Banks Peninsula in recent times. Fire has been the great destroyer here, and it would rather encourage than repress it.

(2) The case of the Carices (*C. pterocarpa* and *C. Kirkii*) is not very difficult. We may infer that *C. pterocarpa* originates from *C. Kirkii* (or of course both from one ancestral form) and that the differences between them are due (in part) to the difference of habitat, one being adapted for life at very high, the other at comparatively low altitudes. This does not preclude the possibility of an origin by crossing of microspecies. *C. pterocarpa* has only very recently been observed beyond Otago and it is so small that it may well have been overlooked and have a far more general distribution than is at present recorded.

There must be many similar cases to this, but the reason why a certain species should in a certain district or districts give rise to a new form while refraining from doing so in others will probably always remain unexplained, though the "new stimulus" of changed conditions (as postulated by Cockayne 1921 in re return of Alpines to mountains in a period of elevation) may be called upon.

(3) The case of *C. McMahoni,* on Mt. Stokes only, and *C. parva,* also in the Northern mountains but at a very considerable distance, or *C. Hectori* which seems not to be recorded in the Northern mountains at all, is very difficult. Here we may assume that the forms descend from a common ancestor and that although the great species-forming activity in *Celmisia* is comparatively recent (Cockayne, 1921) it must go back to a period when geographical conditions were entirely different from the present. The summits of the Northern mountains like Mt. Stokes, Richmond, Rintoul etc. are all in the nature of islets, each supporting an alpine flora isolated in vast areas of forest in which no such flora can exist. The Pleistocene period at least would seem to be demanded for this, though the forest may, of course, be comparatively recent. There are many such cases, where the closest affinity of a rare plant is separated from it by very great distance, especially in *Veronica* and *Celmisia,* and in all of these a truly recent origination seems to be barred.

(4) The Celmisias of the outlying Islands may be taken as typical of this class. It is impossible to say exactly which species of the mainland Celmisias ought to be considered as their affinities. They belong to the herbaceous group; and possibly *C. spectabilis* may be taken as akin to some ancestral form of both *C. Campbellensis* and *C. vernicosa.* Judging by leaf-characters the two are not very closely akin; by flower-characters they are very near relatives. No other Celmisia is recorded from either of these groups of islands.

Here we must push back still further the period at which these species can conceivably have originated, even as far, probably, as the time when these Islands and New Zealand formed one continuous land surface which cannot have been later than the Pleistocene (?).

An alternative is that the seeds of mainland Celmisias have been transported by wind or birds to these Islands and that on their establishment there the plants have developed their own individuality under the new conditions. But these are, however, not "new lands" but remnants of old which renders this last hypothesis improbable. Either alternative seems to demand the (Neo-Lamarckian?) development of distinctive characters by the fixing of "variations" however caused, rather than by hybridisation.

The case of *Pleurophyllum* is not very dissimilar to this. The genus is represented by three species all of which are confined to the outlying islands of New Zealand; none occurs on the mainland or on Stewart Island. It seems to demand a still greater backward extension of time, and we are irresistiby drawn to take into consideration the old hypothetic Antarctica and regard *Pleurophyllum* as one of the most distinctive features of its flora, preserved to us by the continued existence of certain small portions of its area.

(5) The case of a genus representing a single species also demands a further backward extension in time. It is useless to speculate upon a period so remote that a plant like *Logania,* or *Tetrachondra* could originate as a member of a group whose other members have now entirely disappeared, leaving the species almost perfectly isolated. *Euphorbia* can hardly be conceived as giving birth to *Poranthera,* and we can only conjecture what may have been the generic and specific links which will unite these now far-separated forms. The contemplation of these takes us back to the very early history of the Angiosperms when the very existence of land in these regions is problematical. This is the case of "relict endemism"; such species cannot possibly be conceived as " new."

(6) It is difficult to see how the distribution of *Celmisia Traversii* can be explained otherwise than by the hypothesis of polygenesis. The same parent species has apparently become mutable, or varied by crossing of microspecies in two widely separated places, and has given rise in these places and in no others to the same new form. The conveyance of a chance seed from one locality to the other over intervening great mountain chains and a distance of over 200 miles would seem to be incredible. Another alternative would be the hypothesis that the species has once been generally distributed and destroyed in every other locality except these two, but against this commonsense rebels. Yet another hypothesis is suggested by the similar case of *Ranunculus crithmifolius,* where the wide separation of the stations also appears, (Mt. Arrowsmith and the Wairau River, about 200 miles apart) but allowance must be made for imperfect observation.

In this and similar cases we might look to the conception of a high plateau (up to 10,000 or 12,000 feet) with tectonic hollows capable of supporting an Alpine flora, such a plateau as is posited by Cotton and Benson, 1921, in mid-tertiary time. During the process of denudation of such a plateau and its dissection into the ranges as we know them to-day, with long narrow river-valleys separated by high ridges, isolations of particular species may well have been brought about. A plant like *Ranunculus crithmifolius,* originating in such hollows at a considerable altitude might move farther and farther up the neighbouring slopes as the land subsided and the plateau

was dissected out. Its place of origin may have been entirely destroyed, as practically the whole of the covering limestone cap was destroyed, and the plant itself may then survive only in a few widely separated stations where it appeared to have established itself in places which were not doomed.

(7) The Celmisias, *rupestris* and *Gibbsii,* might be supposed to be descended either from *C. Walkeri* or from an ancestral form common to all three. The absence of *C. Walkeri* in their neighbourhood is hard to explain. If all descend from a common ancestor, however, the two rare plants may be supposed to have developed on different lines each in its own restricted sphere in comparatively recent times, whether by mutation or epharmonic variation or crossing with other species we cannot tell.

One very clear and certain result of this study is that Willis's rule of "age and area" will by no means hold good for particular species in many cases. All depends upon affinities. *Olearia insignis* is seen to have a very restricted distribution and according to the "law" it should therefore be of recent birth; but that is impossible unless it arose from some one of the other Olearias by a very rapid series of gigantic mutations, or from some other species or groups which have all quite recently disappeared without cause shown. This reasoning will also apply to *Logania, Mitrasacme, Poranthera, Tetrachondra* and many others, including practically all monotypic genera.

The theory of mutation as set forth by De Vries or of hybridisation as set forth by Lotsy can help to explain some of the difficult cases very fairly. A further consideration is here advanced with great diffidence as affording an explanation of some of the more puzzling distributions. According to De Vries a species or group of species in a state of mutability may throw off swarms of new microspecies in a particular district, but the species itself (or group) does not cease to exist. The mutations are confined to certain individuals and to a certain percentage only of the seeds of a given individual, so that the mutant remains (in nature) while its descendants are to be found in its vicinity. Further, he makes it clear that a particular species may be in a mutable state in a certain district while it is perfectly stable in others.

If, however, it could be found that a particular species had become so mutable within a certain area that all the seeds of every individual bore mutated forms, then the species itself would perish in that area and be represented only by the new form. For example we may conceive an ancestral form antecedent to *Ranunculus Haastii, R. paucifolius, R. chordorhizos,* and *R. crithmifolius* reaching a period of very active mutability and throwing off, in one district by means of every seed, *R. paucifolius,* and itself perishing completely; in another *R. crithmifolius,* and so on. The new species would then exist each in its own area isolated, the "parent" species being absent. The case of *Oenothera* as studied by De Vries is not so very different from this. The single species, in his example, throws off a variety of microspecies at the same time and within the same area, we might ask whether it is not at least possible that it should throw off only one successful microspecies by means of every seed and then itself disappear.

Such a theory presupposes the possibility of a certain unanimity on the part of the species itself or of what we vaguely call "Nature"

which is attractive, no doubt, to the poetic or imaginative mind, but seems hardly to fall within our conception of scientific or proven truth. "Nature," says Cockayne, "recognises only the individual." May it not be true, however, that "she" only recognises the species?

Also there are not wanting some indications in "nature" of a certain invisible bond uniting all the individuals of a given species wherever they may happen to be scattered over the surface of the world. The case of a species of *Bambusa* may be called in evidence. At a certain time in a certain year all sufficiently mature individuals flowered wherever they were, while for many years all had been inactive. This is explained, however, by the fact that all were grown from cuttings and were really the same plant.

The case of the common English scented musk may be also cited; all plants in Europe apparently have lost their scent, however, wherever cultivated, and all with comparative suddenness. And the New Zealand plants have nearly lost it also.

In the animal world there are, of course, many well-known examples of this race-solidarity; such as the instincts governing the migration of insects, birds and small mammals, and changes in the habits of animals and birds; for instance, the case of the starling which became a fruit-eater almost simultaneously in England (Europe) and in New Zealand and Australia where it had been introduced.

Conclusions.

In most cases of restricted or anomalous distribution an explanation is to be sought in one or other of the following:—

(1) Comparatively recent mutations, or crosses, or adaptative modifications producing new forms which are found only within a certain area: *e.g. Helichrysum coralloides* and *H. selago; Senecio saxifragoides* and *S. lagopus; Celmisia McKaui* and *C. coriacea; Carex pterocarpa* and *C. Kirkii.*

(2) Changes in land-surface isolating certain forms, species or genera, these changes being of widely varying age, some comparatively recent (*e.g. Celmisia McMahoni* and *C. Hectori*), others more ancient (*e.g. Poranthera* and *Euphorbia*), others still older (*e.g. Pleurophyllum*).

(3) Carriage of seeds to great distances by wind or birds or other agencies, followed by adaptive modifications or crosses (*e.g. Celmisia vernicosa*). This explanation is not favoured but mentioned only as a remote possibility.

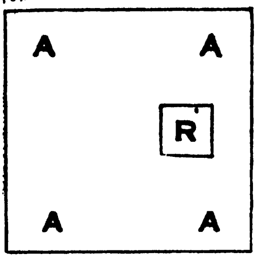
(4) Polygenesis seems inevitably suggested by certain cases, the same form having independently originated in widely separated localities whether by mutation or crossing, or epharmonic variation, *e.g. Celmisia Traversii,* and possibly *C. Petriei.*

(5) The hypothesis of a universal or unanimous change of one species (all individuals) into another, by mutation (as of De Vries) or otherwise, is put forward tentatively as a suggestion in certain very difficult cases, *e.g. Celmisia Traversii.*

The subjoined diagrams are intended to illustrate the particular problems here investigated. R stands for the plant of restricted distribution and A for its nearest affinity. Thus in (1) R stands for *Celmisia McKaui,* restricted to Banks Peninsula, from which *C. coriacea, the* affinity, is absent, while *C. coriacea* is present over the very wide area of the Alps.

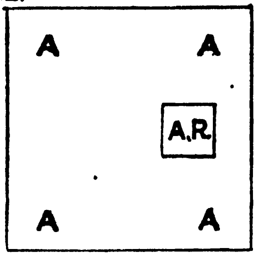
DIAGRAMS.

(1)



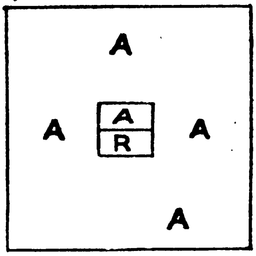
C. McKaui & C. coriacea.

(2)



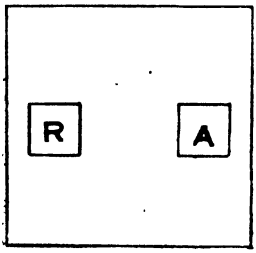
H. Coralloides.
H. Selago.

(3)



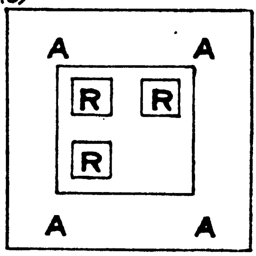
Carex pterocarpa
C. Kirkii
or
W. Cartilaginea.
W. saxicola.

(4)



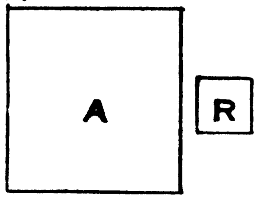
V. rigidula.
V. Colensoi

(5)



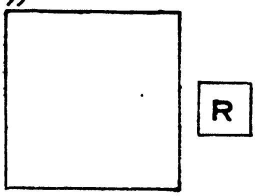
C. McMahoni
C. Hectori.

(6)



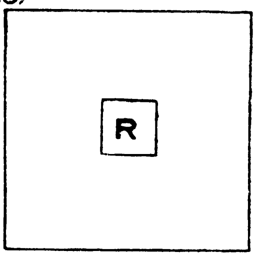
D. pungens.
D. australis.
Myosotidium?

(7)



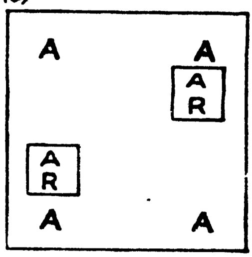
Pleurophyllum.

(8)



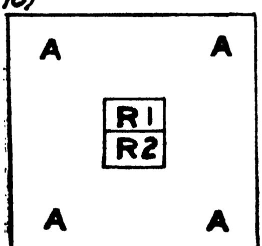
Poranthera.

(9)



C. Traversii and
C. spectabilis.

(10)



C. rupestris.
C. Gibbsii.
C. Walkeri.

The Pollination of New Zealand Flowers by Birds and Insects.

By Geo. M. Thomson, F.L.S., F.N.Z. Inst., M.L.C.

[*Read before the Otago Institute, 8th December, 1925; received by Editor. 31st December, 1925; issued separately, 15th November, 1926.*]

In a paper on "The Fertilization of New Zealand Flowering Plants" read before the Otago Institute in May, 1880, I stated that very little was known as to the relation of birds and insects to flowers in this country. Up to that time only a few scattered references to the subject were available. My own contribution (34) added a little to the sum of knowledge, and since then a few more data have been obtained. But even to-day the amount of information is very fragmentary. Botanists, as a rule, do not trouble themselves with the insects that visit the flowers which they collect; and entomologists are seeking the insects themselves, and seldom notice the flowers they are found on. Yet the subject is one of great interest to the naturalist, as it displays in a marked degree the principle of adaptation in nature. I do not propose to go into the general question in this paper, my object is only to summarize what has been done in New Zealand in the hope that further observations may be made and published.

Pollination of flowers by birds is practically unknown in Britain, and, as far as I know, in Europe. It is found to occur only among certain families of birds, and of these three occur in this country.

MELIPHAGIDAE or Honey-eaters.

1. White-eye; wax-eye; blight-bird; twinkie;—*Zosterops coerulescens.*

These little birds probably visit many kinds of flowers, but have only been definitely recorded by Kirk (21) as seen taking nectar from *Fuchsia excorticata.* Petrie (26) thinks that *Vitex lucens* is visited by small birds, probably of this species.

2. Tui — *Prosthemadera novae-zealandiae.*

3. Bell-bird — *Anthornis melanura.*

Both these species regularly visit the flowers of New Zealand Flax *(Phormium tenax)*, Rewa-rewa or Native Honeysuckle *(Knightia excelsa)*, Kowhai *(Sophora tetraptera)*, *Clianthus puniceus*, various species of Ratas *(Metrosideros)*, and *Fuchsia excorticata.* Scarlet Mistletoe *(Elytranthe Colensoi)*, *Rhabdothamnus Solandri* and *Dracophyllum longifolium* are occasionally visited by birds, and most probably by these two species.

4. Stitch-bird — *Pogonornis cincta.*

This species is now apparently extinct on the main islands of New Zealand, but survives on the Little Barrier, and perhaps on one or two of the smaller outlying islands of the north. Reischek (19) who observed it on the Little Barrier, says "it feeds on small insects and sucks the honey from the native wild flowers and trees."

NESTORIDAE (Parrots).

5. Kaka — *Nestor meridionalis.*

This bird visits *Phormium* when in flower, and no doubt many other plants. Hutton (19) states that "the Kaka sips the honey from the flowers, and this, as well as insects, constitutes part of its diet. In September it has been seen in Canterbury poised on the slender bough of a tall *Panax,* luxuriating on the viscid nectar of its blossoms." Cheeseman (8) reports it on flowers of *Clianthus puniceus.*

PSITTACIDAE.

6. Red-fronted Parakeet — *Cyanorhamphus novae-zealandiae.*

7. Yellow-fronted Parakeet—*C. auriceps.*

These birds have only been recorded on the flowers of *Phormium.* But in early and especially pre-settlement days, when they were extraordinarily abundant, they must have visited and pollinated many species of nectar-producing flowers.

Of insects practically only four orders in New Zealand are flower-visitants, viz. Hymenoptera, Lepidoptera, Coleoptera and Diptera. A very few hemipterous insects are occasionally found on flowers.

The Hymenoptera are poorly represented in New Zealand, and only a few have been observed on native flowers. I have noted a small black bee on *Veronica Traversii* and *V. glaucocoerulea,* and others on other species, but none of these have been identified. *Lamprocolletes fulvescens* a very common native bee, which burrows in dry banks, and lays its eggs in small balls of bee-bread made from pollen, is very common, and may be seen on many introduced garden flowers, but I have never observed it on native flowers, though it must formerly have obtained the pollen which it seeks from them alone.

Great numbers of Lepidoptera are flower visitants, and many flowers appear to be specially adapted for pollination by moths, *e.g.* species of *Leucopogon, Cyathodes,* and similar flowers with hair-lined tubes. Only insects with relatively long and slender proboscides could reach the nectar in such flowers, but I have not a single record of moths being taken on such blossoms. The following species of Lepidoptera have been observed or captured on the flowers named:—

ARCTIADAE.

Nyctemera annulata on *Veronica Traversii.*

CARADRINIDAE.

Orthosia comma Walk. on *Metrosideros scandens,* and sp. of *Veronica.*

Orthosia immunis Walk. on *Metrosideros scandens,* and sp. of *Veronica.*

Leucania griseipennis Feld. on *Veronica* sp.

L. purdii Fered. on *Gaya Lyallii.*

L. atristriga Walk. on *Metrosideros scandens.*

L. alopa Meyr. on *Veronica* sp.

Melanchra maya Huds. on *Veronica* sp.

M. mutans Walk. on *Gaya Lyallii.*

M. pelistis Meyr. on *Metrosideros scandens* and *Veronica* sp.

M. diatmeta Meyr. on *Parsonsia* sp.

M. rubescens Butl. on *Gaya Lyallii.*

Erana graminosa Walk. on *Metrosideros scandens.*

HYDRIOMENIDAE.

Tatosoma agrionata Walk. on *Rubus australis.*
T. timora Meyr. on *Rubus australis.*
Xanthorhoe perfectata Walk. on *Veronica* sp.
X. beata Butl. on *Metrosideros scandens.*
X. umbrosa Philp. on *Dracophyllum longifolium.*

ORTHOSTIXIDAE.

Epirrhanthis alectoraria Walk. on *Metrosideros scandens.*

SELIDOSEMIDAE.

Selidosema productata Walk.
S. aristarcha Meyr.
S. panagrata Walk.
Chalastra pelurgata Walk.
Gonophylla nelsonaria Feld.
Azelina gallaria Walk.
A. ophiopa Meyr.
Ipana leptomera Walk.
} on *Metrosideros scandens.*
Declana floccosa Walk. on *Gaya Lyallii.*

NYMPHALIDAE.

Vanessa gonerilla Fabr. on *Metrosideros scandens.*
V. itea Fabr. on *Veronica salicifolia.*

SATYRIDAE.

Dodonidia helmsi Fereday on *Veronica* sp.

LYCAENIDAE.

Chrysophanus boldenarum White on *Donatia novae-zealandiae.*

I believe the Diptera are the most numerous flower-visitants among New Zealand insects. I expressed the opinion in 1880 (34) that the insects of this order "depend chiefly on scent in their search for food, and certainly this would explain the fact of their being the sole fertilizers of many inconspicuous or green flowers, as *Tupeia antarctica* and various species of *Pterostylis.*" Subsequent observation has only strengthened that opinion. Yet very few species of Diptera have been identified as flower-visitants. Only the following have been recorded:—

Arocera longirostris on *Metrosideros scandens.*
Helophilus cingulatus on *Metrosideros scandens.*
H. hochstetteri on *Veronica* sp.
Syrphus novae-zealandiae on *Veronica* sp. and *Rubus australis.*
Exechia Thomsoni. Miller (Fam. *MYCETOPHYLIDAE*) on *Corysanthes oblonga.*

But the following flowers are probably more or less dependent on Diptera for their pollination:—

Cordyline sp., *Astelia* sp., *Caleana minor,* all species of *Pterostylis, Acianthus Sinclairii, Cyrtostylis oblonga,* all species of *Corysanthes, Loranthus micranthus, Tupeia antarctica* (midge-like Diptera), *Dactylanthus Taylori, Claytonia australasica, Clematis* sp., *Melicope simplex, Metrosideros scandens, M. hypericifolia* and other species, *Nothopanax Colensoi, Schefflera digitata,* most of the fragrant flat-flowered hermaphrodite and dioecious Umbelliferae, *Mentha Cun-*

ninghamii, Glossostigma sp., *Utricularia* sp., most species of *Veronica, Selliera radicans,* and numerous Composites. I believe that many other species are visited by native flies, but have no direct evidence on the subject.

Of Coleoptera the following species have been recorded:—

MELOLONTHIDAE.

Pyronota festiva Fabr. on *Leptospermum* sp.

HYDROPHILIDAE.

Rygmodus modestus White, on *Brachyglottis repanda.*

MELYRIDAE.

Dasytes cinereohirtus Broun, on *Rubus australis* and *Aristotelia racemosa.*

D. Cheesemani Broun, on *Myoporum laetum* and *Wahlenbergia gracilis.*

CRYPTOPHAGIDAE.

Cryptophagus castaneus —?— on *Rubus australis* and *Aristotelia racemosa.*

OEDEMERIDAE.

Selenopalpus cyaneus Fabr. on *Cordyline australis.*

MORDELLIDAE.

Mordella antarctica White, on *Leptospermum* sp.

CERAMBYCIDAE.

Zorion minutum Fabr. on *Rubus australis.*
Navomorpha sulcatus Fabr. on *Rubus australis.*

CHRYSOMELIDAE.

Arnomus Brouni Sharp, on *Leptospermum* sp.

CURCULIONIDAE.

Tigones caudata Broun, on *Pittosporum tenuifolium.*
Erirhinus limbatus Pascoe, on *Pittosporum tenuifolium.*
Eugnomus, all species. (The *Index Faunae Novae–Zealandiae* gives 22 species) on *Rubus australis.*
Hoplocneme Hookeri White, on *Rubus australis.*
Apion metrosideros Broun, on *Metrosideros tomentosa.*
Oropterus coniger White, on *Fuchsia excorticata.*
Colaspis—11 species, on many shrubs.
Empaeotes censorius —?— on *Rubus australis.*
One species (undetermined) belonging to the Staphylinidae on *Selliera radicans.*
Various undertermined species on *Aciphylla squarrosa* and *A. Colensoi.*
Two undetermined species on *Muehlenbeckia adpressa.*

These only represent a small proportion of the flower-visiting beetles.

Since settlement commenced in New Zealand, the destruction of forest by felling and burning, the clearing off of the surface growth of vast areas of native grass, fern and flax land must have destroyed

an enormous amount of insect life. Added to this, the introduction of numbers of foreign birds and insects, as well as of foreign plants, has profoundly modified the original conditions. Many of the indigenous flowering plants are now visited and pollinated by introduced insects, especially bees and flies of various species, and this complicates the task of finding out the native insects which formerly pollinated the native flowers. This has to be borne in mind when studying this question. The number of insects which have been recorded is seen to be very few, though there is no doubt that great numbers of native flowers are dependent on insects for pollination.

Looking at the question now from the botanical point of view the following flowering plants have been recorded either as being visited by insects, or as having flowers attractive to insects by fragrance or nectar, or both.

LILIACEAE.

1. *Cordyline Banksii* Hook. f. visited by the beetle *Rygmodus modestus* (32).
2. *Cordyline australis* Hook. f.

The flowers are very sweet scented, and attract numerous Diptera. I have also collected on it numerous beetles of one species—*Selenopalpus cyaneus.*

3. *Astelia nervosa* Banks and Solander.

Visited by numerous Diptera (32). Kirk (16) says—"All the large kinds (of *Astelia*) are sought after when in flower by bees." Presumably he means introduced honey bees.

4. *Phormium tenax* Forst.

In my note-book I record in 1879 that "the flowers contain immense quantities of honey and are fertilised by honey-birds, tuis, etc." Later on (34) I record them as visited by birds.

IRIDACEAE.

5. *Libertia ixioides* Spreng.

The flowers secrete abundance of nectar. On opening, the anthers and the style-branches diverge in different directions, and only the extremities of the latter are stigmatiferous.

ORCHIDACEAE.

6. *Dendrobium Cunninghamii* Lindl.

The flowers secrete a considerable quantity of nectar and appear quite incapable of self-pollination.

In 1878, out of 22 flowers examined by me, 5 had their pollinia removed. In January 1880 I found the plant flowering in gorgeous profusion in Stewart Island, and examined 80 flowers, but only found 10 with the pollinia removed. I saw no insects actually at work.

7. *Earina mucronata* Lindl.

Flowers very fragrant and producing a considerable quantity of nectar.

8. *Earina autumnalis* Hook. f.

The flowers are fragrant and secrete nectar. They appear to be quite incapable of self-pollination, but I have never seen nor taken insects on them. Out of 91 flowers examined, 41 had the pollinia removed. In 1878 I pollinated six flowers with their own pollinia, and

also cross-pollinated sixteen with pollinia taken from other flowers on the same bunch, but in neither case were they fertilized.

9. *Sarcochilus adversus* Hook. f.

This little species produces minute inconspicuous flowers, which are slightly fragrant and produce a relatively large amount of nectar. They appear (34) to me quite incapable of self-pollination, owing to a mechanical depression and separation of the pollinia when removed from the anther.

10. *Thelymitra longifolia* Forst.

This is a very variable species, some forms bearing conspicuous blue or even white flowers, while others which are nearly always white or pinkish scarcely open their blossoms at all. In my paper on the fertilization of Orchids (33) I stated that the species was probably self-fertilized. Cheeseman (3 and 7) considers them nearly always self-fertilized, and Fitzgerald says the same of the Australian forms of the species. When, however, I was in Stewart Island in January 1880, I found many lilac- and pink-flowered specimens, which were very conspicuous, and in many of them the pollinia had been removed, showing that insects had visited them.

11. *Microtis unifolia* Reichenbach.

The flowers are green and inconspicuous. I could detect neither nectar nor fragrance, yet in one fine spike examined by me (33) I found that 31 flowers out of 32 had the pollinia removed, the top flower being just opened. In the majority of cases, however, and I have examined hundreds of flowers, the pollinia were glued to the upper edge of the stigma, and in many cases the pollen tubes could be detected, showing that self-pollination had taken place.

12. *Prasophyllum Colensoi* Hook. f.

Though the flowers are sweet-scented, and are occasionally visited by insects, they are mostly self-pollinated, as in a majority of those examined the pollen grains were found to be adhering to the stigma. Of 75 flowers examined only 4 had the pollinia removed.

13. *Caleana minor* R. Br.

Cheeseman (9) states "that it seems probable that small Diptera or other minute insects alight on the labellum, which then capsizes, imprisoning the insects in the concavity of the column; that they then disturb the pollinia, and either fertilize the flower with its own pollen, or when escaping convey the pollinia to other flowers. The latter supposition appears to me the most likely; but Mr. Fitzgerald, who had good opportunities of studying the fertilization of the plant in Australia, considers that it is almost invariably self-fertilized."

Kirk (20) describes the same species, and quotes from Fitzgerald's "*Australian Orchids*" as to its method of fertilization. He tried to produce pollination by experimenting with blowflies, houseflies and ladybirds, but was unsuccessful in every case. I think his chosen insects were too large. In most small orchids upon which I have seen flies, they were small species of Culicidae.

14. *Pterostylis Banksii* R. Br.

The flowers of all the species of *Pterostylis* examined by me (33) appear to be incapable of self-pollination, but out of 39 flowers of this

species looked into, only one had the pollinia removed. Cheeseman (3) considered that "the insect which fertilizes this species is nearly twice the size of that which performs the same office for *P. trullifolia.*"

I pollinated a number of flowers of this species with their own pollinia, but the results were inconclusive, as the plants were in the open, and I was not able to follow the experiment satisfactorily.

15. *Pterostylis australis* Hook. f.

I examined 22 specimens of this species, and found that all had their pollinia intact. The flowers may be self-fertilized, though I think it very improbable. The impression in my mind is that the insects which formerly pollinated it are become very rare.

16. *Pterostylis graminea* Hook. f.

The same remarks apply to this species as to *P. Banksii.* Of those examined, the number of which I have unfortunately lost, *none* had the pollinia removed.

17. *Pterostylis trullifolia* Hook. f.

In this species the flowers are fragrant. The labellum is extremely sensitive, springing up at once when touched; only very small insects could enter the flowers, which are only about ½-inch long. Of 14 flowers examined by me, 5 had their pollinia removed, while the other 9 were newly opened and probably had not had time to be visited by insects.

18. *Acianthus Sinclairii* Hook. f.

Cheeseman (4) states that numerous Diptera were seen on a bed of *Acianthus* flitting from flower to flower. Out of 134 flowers examined by him 115 matured their capsules.

19. *Cyrtostylis oblonga* Hook. f.

Cheeseman (4) records that "notwithstanding the minuteness of the flowers they are frequently visited by insects, chiefly minute species of Diptera."

20. *Caladenia bifolia* Hook. f.

My own record of this species (33) states that "the arrangement of the parts (of the flower) is so simple that an insect alighting on the labellum and advancing its head into the base of the flower could hardly fail to remove the pollinia; nor could one entering fail to leave these on the stigma, for in withdrawing pollinia from a flower they are always slightly depressed by the cap of the anther. The pollen is very incoherent, and the lower surface of the stigma projects a little, so that I am inclined to think self-fertilization takes place in flowers which have not been visited by insects. The majority of the flowers appear to set good capsules, and flowers which I fertilized artificially, produced good full seed-vessels." Of 22 flowers growing in the open, 3 had both pollinia removed, in one the pollinia were removed from one anther lobe, in 5 others the pollen masses appeared more or less disturbed, while in the remaining 13 the anthers were untouched.

21. *Corysanthes oblonga* Hook f. D. Miller (in *N.Z. Journ. of Science and Techn.* 1 (1918) 4) describes *Exechia Thomsoni*, a fungus-gnat, which fertilizes this orchid.

21*a*. *Corysanthes rivularis* Hook f.

All the species of *Corysanthes* appear to be incapable of self-pollination, and from the evidence already acquired, the work is done by small Diptera, probably all of the Culicidae, and perhaps each species has its own particular fly. None of the flowers secrete nectar, but when the surface of the labellum is slightly punctured, a considerable amount of sweetish purple juice exudes, which is probably grateful to insects.

22. *Corysanthes macrantha* Hook. f.

I closely examined 143 flowers (33) and found that in 47 the pollinia were still in the anthers, from 90 they had been removed, while in 6, dead or living flies were found glued to the stigma. Of the whole number examined only a small proportion ultimately produced capsules. In addition to the insects which were caught by the viscid stigmas and which were unable to get away again, many flowers were found to contain only wings and legs of flies. This was due to the presence of small spiders which seemed to lie in wait for the flies which were entering the flowers, and in many cases captured them while inside. Indeed I think that all the insects which were found glued to the stigmas got caught there in their endeavours to escape from the spiders. In every case in which an insect was found by me withdrawing from a flower, the pollinia were removed also, securely attached to the front of the head. I regret that I did not preserve these flies, as I could not get them identified at the time.

PROTEACEAE.

23. *Knightia excelsa* R. Br.

Cheeseman (2) described the pollination of this species in 1882. He says "It is natural to assume that the transference of the pollen is done through the agency of insects, especially as the great abundance of honey induces many to visit the flowers. But in many cases they simply crawl about between the styles and never touch either the pollen or stigma elevated far above them. It appears to me that large insects only could aid in the work of fertilization; and even among these the nocturnal or crepuscular moths could be of little service, as the styles are far enough apart to allow of their proboscides being inserted without touching. Possibly some of the larger Diptera or Coleoptera, as well as the honey-bee (which is a regular visitant), may be of use; but the conclusion I have arrived at is that the flowers are principally adapted for a fertilization by honey-feeding birds such as the Tui *(Prosthemadera)* and Korimako *(Anthornis)*. That the former bird regularly frequents the flowers I have repeatedly noticed, and old and observant residents, who were well acquainted with the Korimako before its disappearance from the northern forests, all agree in stating that it was equally ready to take advantage of the luscious supply of honey offered by the plant. The exact mode of fertilization hardly needs describing; it is obvious that the bird, in thrusting its head between the styles (stamens ?) of a recently

nded raceme, must dust the feathers of the forehead and throat pollen, and that when it visited flowers in a more advanced stage, pollen would be rubbed off on the style, and probably smeared the stigma."

LORANTHACEAE.

24. *Elytranthe Colensoi* Engl.

The flowers of this handsome species have no scent and apparently no nectar. It is probable, however, that this is developed at some period of their being open, and that it attracts tuis and bell birds, but I have never actually seen the birds visiting the flowers.

25. *Loranthus micranthus* Hook. f.

The flowers are minute and green, but are sweet-scented, and are probably visited by small Diptera.

26. *Tupeia antarctica* Cham. and Schl.

The flowers are strictly dioecious. Both male and female flowers are very fragrant, and secrete a relatively large amount of nectar. They are much frequented by numerous midge-like Diptera, which in sucking the nectar from the flat discs bring the lower parts of their bodies into contact with the stamens or stigmas.

BALANOPHORACEAE.

27. *Dactylanthus Taylori* Hook. f.

Townson, reported by Cheeseman (10) states that the scent of the monoecious flowers was so attractive to flies that all day long it was surrounded by a little crowd of them. Kirk (20) quotes Mr. Hill as saying that "he was enabled to discover the plant solely through the daphne-like fragrance which it emitted." Mr. Hill, twenty-five years later (*Trans. N.Z. Inst.* 56 (1926) 89), says, "The perfume was overpowering."

POLYGONACEAE.

28. *Muehlenbeckia australis* Meissn.

In my paper (34) published in 1880) I stated that the species of this genus were dioecious or polygamous, destitute of scent and nectar, and that I had not noticed any insects visiting them. More recently, however, I have found two species of beetles (unidentified) visiting them, probably for the pollen.

PORTULACEAE.

29. *Claytonia australasica* Hook. f.

The flowers are very fragrant, have a little nectar at the base, and are visited by large numbers both of flies and moths, belonging to several distinct species.

RANUNCULACEAE.

30. *Clematis indivisa* Willd.

31. *C. hexasepala* DC.

I have never detected either nectar or fragrance in the flowers, and have assumed that they were visited for their pollen only. But in a note made on 30th October, 1898, I wrote that "I have been watching a hive bee and several species of flies on the flowers of *C. indivisa.* There must be some attraction beyond the pollen, for these insects were thrusting their trunks down to the bases of the filaments, and finding something grateful there."

32. *Clematis foetida* Raoul.

The flowers are very strongly scented, at times almost over-poweringly so, but I have not seen insects on them.

33. *Clematis marata* J. B. Armstr.

34. *C. quadribracteolata* Col.

Cheeseman states (10) that both these species are sweet-scented.

35. *Ranunculus Matthewsii* Cheesem.

Cheeseman states (13) that this species is sweet-scented. It is probable also, that its nearest ally *R. Buchanani* Hook. f. is also fragrant. I have not detected either fragrance or nectar in the flowers of *R. Lyallii* Hook. f., or in *R. nivicola* Hook. f., nor in any of the smaller buttercups. Yet all seem fitted for insect pollination, and have one or more scale-like nectaries at the base of each petal. I have no record of insects visiting any species of *Ranunculus.*

36. *Caltha novae-zealandiae* Hook. f.

The flowers are sweet-scented, and are almost certainly entomophilous.

SAXIFRAGRACEAE.

37. *Carpodetus serratus* Forst.

The flowers are conspicuous in their broad panicles. They are very fragrant and produce a large amount of nectar. They are also strongly proterandrous, but I have not detected any insects on them.

PITTOSPORACEAE.

38. *Pittosporum tenuifolium* Banks and Sol.

The flowers have no perceptible fragrance, but have small beads of nectar at the base of the filaments. I have found two species of beetles visiting them, viz. *Erirhinus limbatus,* and *Tigones caudata.*

39. *Pittosporum eugenioides* A. Cunn.

The flowers are very fragrant and contain a considerable quantity of nectar between the bases of the filaments and the ovary. I have not seen insects on the corymbs, except introduced flies.

40. *Pittosporum Dallii* Cheesem.

According to Cheeseman (13) the fragrance of the flowers is an attractive characteristic.

CUNONIACEAE.

41. *Weinmannia racemosa* Linn. F.

The flowers, which are in very conspicuous racemes, are sweet-scented, and contain a considerable quantity of nectar.

ROSACEAE.

42. *Rubus australis* Forst.

The flowers are always dioecious; they are very sweet-scented and contain a considerable quantity of nectar. They are visited by many species of insects, some of which come for nectar, and some (the beetles principally) for pollen. I have found on them (34) numerous hairy Diptera of the size of a large house-fly, and also specimens of *Syrphus novae-zealandiae*. The following beetles are also common on the flower panicles:—

Empaeotes censorius, Pascoe; *Hoplocneme Hookeri* White; *Cryptophagus castaneus* Broun; (very abundant); *Dasytes cinereohirtus* Broun (common); *Zorion minutum* (common); *Navomorpha sulcatus*, and all the New Zealand species of *Eugnomus*. Phillpott states (30) that the moths *Tatosoma agrionata, T. tipulata* and *T. timora* are much attracted by the blossoms of *Rubus*.

43. *Potentilla anserina* Linn.

The flowers are faintly sweet-scented and contain a small quantity of nectar. In Europe this species is visited by numerous Coleoptera and Diptera, and by a few bees, but there is no record in New Zealand.

LEGUMINOSAE.

44. *Carmichaelia grandiflora* Hook. f.

Cheeseman states (11) that "the odour of the flowers is decidedly pleasant."

45. *Carmichaelia odorata* Col.

Cheeseman quotes (11) Colenso, the first discoverer of this species as being "much impressed by the odour of the flowers which filled the air with their fragrance."

46. *Carmichaelia flagelliformis* Col.

The flowers are very fragrant and contain a considerable amount of nectar, but no insects have been recorded as visiting them.

47. *Clianthus puniceus Banks* and Sol.

I stated (34) in 1880 that this species was visited by birds. The flowers have no scent, but the cup-like calyx contains a large drop of nectar. It is this which attracts the honey-birds *(Anthornis)*, which search the blossoms with great diligence. Cheeseman (9) mentions that the *Clianthus* "was visited by a stray Kaka which spent the greater part of the day sucking the honey from the flowers."

48. *Sophora microphylla* Ait.

The flowers are not fragrant, but they contain a quantity of nectar in the base of the calyx-cup. They are particularly attractive to tuis and bell-birds, but, according to Cheeseman (9) are not exclusively fertilized by birds.

OXALIDACEAE.

49. *Oxalis lactea* Hook.

The flowers are without fragrance or nectar, and their stigmas get covered with pollen as the corollas wither, yet they appear to be in-

capable of self-fertilization. I have kept numbers under glass and flowered them freely, but they never set a seed. They are probably pollinated by the numerous small Diptera which occur so abundantly in the bush.

LINACEAE.

50. *Linum monogynum* Forst.

The flowers are scentless and do not contain nectar, but from imperfect observations made by me, I gather that they do not produce seed when self-pollinated. I have only observed one species of fly on them, but this was not identified.

RUTACEAE.

51. *Phebalium nudum* Hook.

Cheeseman (10) notes the fragrant character of the flowers.

52. *Melicope simplex* A. Cunn.

The flowers are usually unisexual, and are faintly sweet-scented. I have elsewhere stated (34) that "I think them entirely dependent for fertilization upon the small Diptera which so commonly frequent the edges of the bush."

ICACINACEAE.

53. *Pennantia corymbosa* Forst.

The flowers are dioecious and very fragrant, and are evidently entirely dependent on insects for pollination.

RHAMNACEAE.

54. *Discaria Toumatou* Raoul.

The flowers are almost oppressively fragrant and secrete a large quantity of nectar.

ELAEOCARPACEAE.

55. *Elaeocarpus Hookerianus* Raoul.

The flowers, though always hermaphrodite, are proterandrous. I have not observed any fragrance, but they produce a considerable amount of nectar at the base of the filaments.

56. *Aristotelia racemosa* Hook. f.

Usually dioecious, but ranging from "male flowers having no trace of a pistil to female flowers quite destitute of even the rudiments of stamens, and to hermaphrodite flowers having the full complement of both stamens and carpels." They have neither fragrance nor nectar, but are visited — apparently for their pollen, — by several species of beetles, *e.g. Cryptophagus castaneus, Dasytes cinereohirtus,* and *Erirhinus thomsoni.*

MALVACEAE.

57. *Plagianthus divaricatus* Forst.

Flowers dioecious, producing little or no nectar, but very fragrant.

58. *Plagianthus betulinus* A. Cunn.
Also dioecious, but very fragrant.

59. *Gaya Lyallii* J. E. Baker.
Hamilton (16) collected the following moths from flowers of this plant,— *Declana floccosa, Melanchra rubescens, M. mutans* and *Leucania purdei.*

VIOLACEAE.

60. *Melicytus ramiflorus* Forst.
The flowers are dioecious, very fragrant and contain much nectar. I have never detected any insects on them, but Oliver (22) when in the Kermadec Islands, found that lace-wing flies (Neuroptera) were visiting them.

61. *M. lanceolatus* Hook. f. Also fragrant and nectariferous.

THYMELAEACEAE.

62. *Pimelea longifolia* Banks and Sol.
Flowers polygamous, dioecious and sweet-scented.

63. *Pimelea prostrata* Willd.
Flowers quite or nearly dioecious, fragrant, and with a considerable quantity of nectar in the perianth tube.

MYRTACEAE.

64. *Leptospermum scoparium* Forst.

65. *L. ericoides* A. Rich.
Both species of Manuka have fragrant flowers which secrete a quantity of nectar. They seem to be chiefly pollinated by various beetles, of which I have taken three species, viz. *Mordella antarctica, Pyronota festiva,* and *Arnomus brouni.* Philpott (29) has also captured on them the moth *Trachypepla euryleucota.*

66. *Leptospermum Sinclairii* T. Kirk.
Cheeseman (11) quotes Kirk as saying that "the flowers are fragrant and are produced in immense profusion."

67. *Metrosideros lucida* A. Rich.
The flowers of the Southern Rata are chiefly visited by tuis and bell-birds.

68. *Metrosideros hypericifolia* A. Cunn.
I reported this formerly (34) as sometimes visited by birds, but more probably by large Diptera, but I have not received further confirmation of this.

69. *Metrosideros robusta* A. Cunn.
Colenso states (11) that he thinks the moth *Hepialus* visits the flowers, which abound in honey.

70. *Metrosideros villosa* Sm.
According to Oliver (24) this Kermadec Island species is visited by tuis.

71. *Metrosideros tomentosa* A. Rich.

Visited by a beetle—*Apion metrosideros*—which, according to Broun, confines itself exclusively to this species.

72. *Metrosideros scandens* Sol.

The flowers of the White Rata have been a favourite collecting ground for many entomologists, and Hudson especially (17 and 18) has recorded the following species of Lepidoptera as frequenting them:—*Orthosia comma* Walk., *O. communis* Walk., *Leucania atristriga* Walk., *Melanchra pelistis* Walk., *Erana graminosa* Walk., *Xanthorhoe beata* Butl., *Epirranthis alectoraria* Walk., *Selidosema productata* Walk., *S. aristarcha* Meyr., *S. panagrata* Walk., *Chalastra pelurgata* Walk., *Gonophylla nelsonaria* Feld., *Azelina gallaria* Walk., *A. ophiopa* Meyr., *Ipana leptomera* Walk., and *Vanessa gonerilla* Fabr.

Also the following Diptera,—*Arocera longirostris,* and *Eristalis cingulatus.*

73. *Myrtus obcordata* Hook. f.

74. *M. pedunculata* Hook. f.

Both species have very fragrant flowers, which are distinctly proterandrous.

ONAGRACEAE.

75. *Fuchsia excorticata* Linn. f.

The flowers of this species are largely pollinated by birds, a fact which has been recorded by several observers, the principal visitants being the tui and the bell-bird. Kirk (21) has the following note on the subject:—"The chief agents in effecting fertilization are the Tui *(Prosthemadera novae-zealandiae)*, the Bell-bird *(Anthornis melanura)*, and in the extreme north, the Stitch-bird *(Pogonornis cincta)*. I suspect that the Parakeets *(Platycercus novae-zealandiae* and *P. auriceps)* assist in the process; the White-eye *(Zosterops caerulescens)* and, in some cases, the naturalised sparrow, although not honey feeders, certainly render assistance, as the blue pollen grains are frequently found on their feathers. They doubtless frequent the trees in search of insects, while the tui, the bell-bird and the stitch-bird are attracted by the honey."

The only beetle recorded by Broun (34) as visiting the native Fuchsia is *Oropterus coniger,* but how far it assists in pollinating the flowers I do not know.

ARALIACEAE.

76. *Nothopanax simplex* Seem.

77. *N. Edgerleyi* Harms.

Both species are fragrant and contain a considerable quantity of nectar.

78. *N. Colensoi* Seem.

This species, which is also sweet-scented and nectar-producing, is visited by large hairy brown Diptera.

Hutton (19) refers to a kaka visiting a tall *Panax* for the nectar, but does not specify which.

79. *Schefflera digitata* Forst.

The flowers are fragrant and secrete much nectar. They are visited by very many flies, especially blowflies, but whether native or introduced, I cannot say.

UMBELLIFERAE.

I stated in 1880 (34) that "I believe that most of our flat-flowered hermaphrodite Umbelliferae are fertilized by Diptera (and perhaps minute Coleoptera)."

80. *Aciphylla Colensoi* Hook. f.

81. *A. squarrosa* Forst.

Both species are dioecious; their flowers produce abundance of nectar, and are very fragrant. They are visited by great numbers of Coleoptera and Diptera of several species.

CORNACEAE.

82. *Corokia Cotoneaster* Raoul.

The flowers are sweet-scented, brilliantly coloured, and the base of each petal is furnished with a tuft or scale of glandular hairs which secrete a little nectar.

ERICACEAE.

83. *Gaultheria antipoda* Forst.

This species is polygamous and in many cases dioecious. The flowers always contain a little nectar, but I have not detected any fragrance.

84. *Gaultheria rupestris* R. Br.

The flowers of this species also contain a little nectar, and are sometimes quite fragrant.

EPACRIDACEAE.

85. *Pentachondra pumila* R. Br.

The corolla tube is bearded within, and the flower is most probably pollinated by small long-trunked moths.

86. *Leucopogon Fraseri* A. Cunn.

The flowers are very fragrant. The corolla tube is thickly lined with hairs, and at its base contains a considerable quantity of nectar, which could only be reached by insects with relatively long slender trunks. Nearly always where *Leucopogon* is flowering numbers of small moths are abundant among the herbage.

87. *Dracophyllum longifolium* R. Br.

The flowers are in very conspicuous clusters, contain a great deal of nectar, and are very fragrant. They are occasionally visited by birds (34), and Philpott (30) has recorded a moth—*Xanthorhoe umbrosa* Philp.—as being common on flowers of plants growing at an elevation of 3,250 feet on the Hunter Mountains. He has also taken *Aletia gourlayi* on a *Dracophyllum*, probably this species.

GENTIANACEAE.

None of the flowers of species of *Gentiana* examined by me have either nectar or scent, but they are so markedly proterandrous, that self-pollination seems to be impossible.

APOCYNACEAE.

88. *Parsonsia heterophylla* A. Cunn.

The flowers are fragrant and contain a large quantity of nectar at the bottom of the tube, which can only be reached by an insect with a relatively long trunk. The pollen is contained inside a cap, and at first sight appears to be placed directly on the stigma. But the flowers are visited by numbers of moths, which probably cross-pollinate the flowers. Philpott (28, 29, and 30) has collected the following species of these flowers:—*Leucania semivittata, Melanchra plena, M. diatmeta, Tatosoma timora, T. topea, Asaphodes megaspilata,* and *Xanthorhoe beata.*

BORAGINACEAE.

89. *Myosotis Cheesemanii* Petrie.

90. *M. Traversii* Hook. f.

91. *M. concinna* Cheesem.

92. *M. macrantha* Hook. f.

All these forget-me-nots are sweet-scented, the latter deliciously so, and are probably very attractive to insects, but I have no record of the fact.

VERBENACEAE.

93. *Vitex lucens* T. Kirk.

Petrie (26) states that "though the secretion of nectar is both abundant and long-continued, flying insects do not frequent the flowers. There is no doubt that pollination is effected exclusively by small birds. These constantly visit the flowers, hang on the rigid leaf-stalks or flower-stalks, and insert their bills into the corolla-tube to suck the nectar. In sucking the sweet juice the tui may be seen grasping a flower in one foot and turning it round into a more convenient position."

LABIATAE.

94. *Mentha Cunninghamii* Benth.

The flowers are very fragrant and full of nectar; they are visited by numbers of small moths (unidentified) and probably by small Diptera.

SCIOPHULARIACEAE.

95. *Glossostigma elatinoides* Benth.

Cheeseman (6) states—"I have not been able to systematically watch the flowers so as to ascertain what species are instrumental in transferring the pollen, but I have twice observed small Diptera engaged in sucking the flowers. Several of these I caught, and found grains of pollen on the foreheads of some of them.

The genus *Veronica* contains a very large number of species, and probably many hybrids, which are difficult of determination, and consequently both collectors of plants and insects have in most cases not attempted to identify the species. I have only direct observations on three of them.

96. *Veronica salicifolia* Forst.

The flowers are visited by great numbers of insects, chiefly Diptera and moths, besides one or two butterflies, including *Vanessa gonerilla* and *V. itea.*

97. *Veronica elliptica* Forst. visited chiefly by Diptera.

98. *V. Traversii* Hook. f.

Visited by great numbers of insects, chiefly Hymenoptera and Diptera; also some moths, including *Nyctemera annulata.*

99. *Veronica pimeleoides* Hook. f.

I have only observed a small blackish native bee (unidentified) on the blossoms.

The following insects have been collected on the flowers of various unidentified species of *Veronica*:—

Lepidoptera. *Dodonidia helmsi, Leucania alopa, L. griseipennis, Melanchra pelistis, M. maya, Orthosia comma,* and *Xanthorhoe perfectata.*

Diptera. *Helophilus hochstetteri* and *Syrphus novae-zealandiae.*

GESNERIACEAE.

100. *Rhabdothamnus Solandri* A. Cunn.

Petrie (25 and 27) has found that the flowers are pollinated by tuis, and probably by bell-birds.

LENTIBULARIACEAE.

101. *Utricularia monanthos* Hook. f.

I examined this species carefully (34) and concluded that it is incapable of self-pollination, but that it was visited by small Dipterous insects.

MYOPORACEAE.

102. *Myoporum laetum* Forst. f.

The flowers have little or no scent (34) but secrete a little nectar, which, however, is guarded from certain small insects by a lining of hairs in the corolla. The only insects I have observed on the flowers are small black beetles,—*Dasytes Cheesemani.*

CAPRIFOLIACEAE.

103. *Alseuosmia macrophylla* A. Cunn.

The flowers are remarkably sweet-scented. Cheeseman states (11) that when Cunningham discovered the species, the plant was in full bloom, and the delicious fragrance of the flowers made such an impression upon him that he gave it its generic name *Alseuosmia,* from two Greek words meaning *a grove* and *a sweet smell.*

CAMPANULACEAE.

104. *Pratia angulata* Hook. f.

The flowers are faintly sweet-scented and have a considerable quantity of nectar. They are proterandrous and quite incapable of self-pollination.

105. *Wahlenbergia gracilis* Schrad.

106. *W. albo-marginata* Hook.

Both species are evidently quite dependent on insect aid for their pollination (34). The flowers are markedly proterandrous and secrete a small amount of nectar. I have taken a beetle—*Dasytes Cheesemani* on *W. gracilis.*

GOODENIACEAE.

107. *Selliera radicans* Cav.

Cheeseman (5) states that the flowers are visited by numerous insects of various orders, but considers that fertilization is chiefly effected by Diptera. Of these "some 12 or 13 species have been observed, some of which, however, are of small size and but poorly fitted for the work of transporting pollen. Two or three Hymenoptera have been noticed, including the hive-bee. I believe that several nocturnal Lepidoptera are constant visitors. A butterfly — *Leptosoma annulatum* — has often been seen similarly engaged. One species of the Staphylinidae is not uncommon about the flowers."

118. *Scaevola gracilis* Hook. f.

Cheeseman (10) states that the flowers are sweet-scented.

STYLIDIACEAE.

109. *Donatia novae-zealandiae* Hook. f.

I have not detected fragrance or nectar in the flowers, but they are produced in such conspicuous masses, and their pollen is so adhesive, that they suggest pollination by insects. Hudson (17) has captured *Chrysophanus boldenarum* on the flowers.

COMPOSITAE.

A great many species of this order are evidently entomophilous, but very few insects have been identified as associated with the pollination of their flowers. I have only recorded a few observations on the order. *Olearia macrodonta* Baker, *O. ilicifolia* Hook. f., *O. arborescens* Cockayne and Laing, *O. fragrantissima* Petrie, *O. Hectori* Hook. f., *O. odorata* Petrie and *O. virgata* Hook. f., are all more or less powerfully fragrant. Of the genus *Celmisia* I have observed slight fragrance and a little nectar in *C. gracilenta* Hook. f., but can hardly doubt but that many other species are similarly endowed with attractions for insects. Other fragrant species are *Helichrysum bellidioides* Willd., *Cassinia fulvida* Hook. f., *Brachyglottis Rangiora* Buch., (which is visited especially by a beetle *Rygmodus modestus)* *Senecio rotundifolius* Hook. f., and *S. Bidwillii* Hook. f. Several species of *Senecio,* though scentless, produce a little nectar, such as *S.*

lagopus Raoul, *S. bellidioidea* Hook. f., *S. Lyallii* Hook f., and *S. lautus* Forst.

To summarize the position, it is quite evident that only a small proportion of the flower-visiting insects have been actually dealt with, but I have no means of knowing what that proportion is.

Similarly only some 120 plants have been specifically referred to, which is less than 8 per cent. of the total number of known species. Of course whole orders such as the *CYPERACEAE, GRAMINEAE,* and all their allies, are either anemophilous or are wind-pollinated; as are whole genera of other orders, *e.g. Coprosma.* On the other hand, though there is no direct evidence on the subject, the vast majority of the New Zealand representatives of such orders as the *ORCHIDACEAE, SCROPHULARIACEAE, ONAGRACEAE, LEGUMINOSAE,* etc., and of such genera as *Celmisia, Olearia, Myosotis, Gentiana, Dracophyllum* and many others, are certainly entomophilous.

My main object, therefore, in drawing up this paper, is to urge on both entomologists and botanists a closer examination of their collected material from this standpoint of the inter-relation of the two groups. Experimental work also on a great number of hermaphrodite flowers will show that they are quite infertile with their own pollen. I have already shown this for a few species, and it is a matter which could easily be tested by cultivators of native flowers.

The subject is one which members of field clubs could do much to elucidate. Many such embryo naturalists are content to collect a few plants or insects, or even only to watch (not necessarily to observe) while others collect, under the erroneous impression that they are not competent to add to the sum of scientific knowledge. Every one who will take the trouble to record the simplest observation made, may bring to light some fact of scientific importance, and it is by the accumulation of such little recorded facts that much of our knowledge of natural history is built up.

LITERATURE CITED.

(*Trans.=Transactions of the New Zealand Institute*).

1. BROUN, CAPTAIN THOMAS, *Trans.* vol. 8, p. 268.
2. CHEESEMAN, THOMAS F., "Fertilization of *Knightia,*" *N.Z. Journ. of Science,* vol. 1, p. 173, 1882-83.
3. —— "On the fertilization of the N.Z. species of *Pterostylis.*" *Trans.* 5, pp. 352-56.
4. —— "On the fertilization of *Acianthus* and *Cyrtostylis,*" *Trans.* 7, pp. 349-51.
5. —— "On the fertilization of *Selliera,*" *Trans.* 9, pp. 542-44, 1877.
6. —— "On the fertilization of *Glossostigma,*" *Trans.* 10, pp. 353-55, 1878.
7. —— "On the fertilization of *Thelymitra,*" *Trans.* 13, p. 409.
8. —— "Notes on fertilization of *Knightia,*" *Australn. Assocn. for the Adv. of Science,* 1890, 473-75.
9. —— "On some recent additions to the N.Z. Flora," *Trans. N.Z. Inst.,* 24, 1892, 409.
10. —— "*Manual of the New Zealand Flora.*" 1906.
11. —— "*Illustrations of the New Zealand Flora.*" 1914.
12. —— "Contributions to knowledge of the Flora of New Zealand," *Trans.* 52, p. 12.
13. —— *Manual of the New Zealand Flora ed.* 2, 1925
14. COLENSO, WILLIAM, "On the metamorphosis of *Dasypodia selenophora,*" *Trans.* 11, p. 304.

15. COHEN, WALTER, "On the abundance of *Vanessa itea* in Wellington during season 1894." *Trans.* 27, p. 281.
16. HAMILTON, HAROLD, "Notes on entomological collecting tours during the seasons 1908-9 and 1909-10." *Trans.* 43, pp. 120-24.
17. HUDSON, G. V., "*Elementary Manual of N.Z. Entomology*," 1892, 56-78.
18. —— "*New Zealand Moths and Butterflies*," 1898, 7-118.
19. HUTTON, F. W. and JAS. DRUMMOND, *The Animals of New Zealand.* pp. 97-143, 1904.
20. KIRK, THOMAS, "On Australian Orchids in New Zealand," *Trans.* 24, p. 426.
21. —— "New Zealand Fuchsias," *Trans.* 25, p. 263.
22. —— "On *Dactylanthus Taylori*," *Trans.* 28, p. 493.
23. MARSHALL, P., "New Zealand Diptera," *Trans.* 28, pp. 221, 312 and 498.
24. OLIVER, REGINALD B., "The vegetation of the Kermadec Islands," *Trans.* 42, p. 141.
25. PETRIE, DONALD, "On the pollination of *Rhabdothamnus Solandri*," *Trans.* 35, p. 321.
26. —— "On the pollination of the Puriri—*Vitex lucens*," T. Kirk. *Trans.* 37, pp. 409-411.
27 —— "Note on the pollination of *Rhabdothamnus Solandri*," *Trans.* 45, p. 264.
28. PHILPOTT, ALFRED, "Catalogue of Southland Lepidoptera," *Trans.* 33, pp. 168-78.
29. —— "On some species of Lepidoptera from Southland," *Trans.* 35, pp. 246-48.
30. —— "Notes on Southern Lepidoptera," *Trans.* 36, pp. 161-64.
31. —— "List of the Lepidoptera of Otago," *Trans.* 49, pp. 201 and 241.
32. —— "Notes and descriptions of N.Z. Lepidoptera," *Trans.* 53, p. 337.
33. THOMSON, GEO. M., "Fertilization of some New Zealand Orchids," *Trans.* 11, pp. 418-426.
34. —— "Fertilization, etc. of New Zealand Flowering Plants," *Trans.* 13, pp. 241-291.

A Reference List of New Zealand Marine Algae.

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Introductory Remarks.

Our knowledge of New Zealand seaweeds commenced with Cook's first voyage. The specimens collected by Sir Joseph Banks and Dr. Solander in 1769-70 were handed over to Dawson Turner and described by him in his *Fuci sive Plantarum Fucorum Generi a Botanicis Ascriptarum*, vol. 1, of which was published in 1808; and the final vol. 4 in 1819. The whole work is dedicated to the Right Honourable Sir Joseph Banks; and the first species is *Fucus Banksii* [*i.e. Hormosira Banksii* (Turn.) Decaisne]. These four volumes constitute the first English work of importance dealing with the seaweeds in general. *Fucus Banksii* however was not here described from New Zealand, but from New Holland, collected by Menzies and Brown, of Captain Vancouver's expedition in 1791 and presumably handed over to Sir Joseph Banks. There are however some fifteen species ascribed to New Zealand amongst those collected by Banks and Solander. Of *Fucus Banksii* Turner writes, "For my specimens of this most extraordinary Fucus, I am indebted to the Right Honourable Sir Joseph Banks by whose name I have called it, in memory of the kindness which he has always shewn to me, and of the exceeding liberality with which he has assisted me in the present publication." The figure accompanying the description is that of an extremely mutilated but still recognisable specimen of *Hormosira*. Amongst the plants from New Zealand in this monumental work, the two most striking are probably *Fucus maschalocarpus*, and *F. phyllanthus;* these are now placed under the genus *Carpophyllum*. In the advertisement Turner concludes thus, " The author . . . feels a satisfaction in taking leave of his readers with the consciousness of having laid before them a set of figures, upon the accuracy of which they may rely, and which, as representations of things that are, will, through every change of human opinions, retain an undiminished value, while they may serve, in the hands of some more able, and more fortunate successor, as the ground work of that which he had hoped to accomplish himself." Turner's claim is not extravagant, and is justified by the fact that for more than a century his volumes have remained the final court of appeal, for the specific names of many seaweeds.

The next voyage of discovery to be mentioned is that of the French exploring corvette " Coquille," 1822-24, under Captain Duperry, with Dumont D'Urville as one of his officers. More important however is the voyage of the " Astrolabe " (the " Coquille," re-named) under Captain Dumont D'Urville. The botanist of this expedition as of the previous was A. Lesson, whose name is perpetuated in the remarkable genus of seaweeds known as *Lessonia.* The botanical results of this expedition contributed by Lesson and Richards were

published in 1832, and contain 29 species of New Zealand seaweed, of these however 8 were collected by Banks, one by the Forsters of Cook's second expedition, and one by Andrews, so that our knowledge of the seaweeds grew but slowly. The most important discoveries of Lesson and Richard, were the seaweeds placed by them in the genus *Marginaria;* this still remains one of the most characteristic of the distinctively New Zealand genera.

In 1837-40 D'Urville (now admiral) paid a third visit to New Zealand in command of the "Astrolabe" and Zélée and collected largely at Port Ross in the Auckland Islands. The seaweeds are described by Montagne in the *Voyage au Pôle Sud,* Bot. Crypt. 1845. There are some fifty species enumerated, with excellent illustrations and drawings. In addition to the Auckland Island specimens, a number were obtained from the Bay of Islands and Akaroa.

A few months later Sir James Ross in command of the "Erebus" and "Terror" also explored the Auckland and Campbell groups. With him were Dr. J. D. Hooker (afterwards Sir Joseph Hooker) and Dr. Lyall. The seaweeds are described in the first volume of the *Flora Antarctica* (1845) and shew a large increase in number of species and in accuracy of description, and indeed the *Flora Antarctica* constitutes a landmark on the road to our present knowledge of the New Zealand marine Algae.

The *Flora Novae-Zelandieae* appeared in 1853-55, and in 1864 Hooker's *Handbook of the New Zealand Flora* was published, containing short descriptions of all the seaweeds known from these islands up to date. It still remains the only work in England in which the student can obtain a general account of the local species. In it are described some 317 species, *Clorophyceae* 40; *Rhodophyceae* 219; *Phaeophyceae* 58. The work is by Hooker's collaborator, W. H. Harvey, who himself had never visited New Zealand. Considering the circumstances under which it was completed, it may be considered a remarkable achievement, though it is often far from reliable. It includes many Australian species, and some of the descriptions—even for the day in which they were written—do not reach a high standard of accuracy. This makes it impossible for one without type-species to identify a considerable number of Harvey's plants. In the late sixties Baron F. von Mueller sent to Dr. Agardh of Lund a number of specimens of seaweeds collected by Mr. H. H. Travers in the Chathams; a list of these appears in *Trans. N.Z. Inst.* 6 (1874) 208-210. A fuller account had been published at Stockholm under the date 11th May, 1870; this is particularly valuable for the discriminations of the various species of *Cystophora* and is the first account of the species from the Chathams. In 1877, Prof. Agardh published a complete list of the New Zealand seaweeds, under the title *De Algis Novae Zelandiae marinis.* This is based on the collections of Dr. S. Berggren made during the years 1874-75, and is an immense improvement upon Harvey's list, though it includes only 277 species. Agardh excluded about seventy-two species included in the *Handbook,* and only a few of these have since been restored. Harvey had died before the publication of the *Handbook of the New Zealand Flora,* and doubtless had the Algae therein been revised by him, the work would have been considerably improved.

In *Trans. N.Z. Inst.* 32 (1900), I published a "Revised List of the New Zealand Seaweeds Part 1." This contained the *Chlorophyceae* and *Phaeophyceae.* Part 2 of this paper *(Florideae)* was published in 1902, and an Appendix in 1905, including in all some 419 species.

Since that date much work has been done on the seaweeds in general, and a certain amount on the New Zealand species. In 1901, Falkenberg subjected the family *Rhodomelaceae* to a critical examination, which resulted in a very large number of generic changes. I was unfortunately unable to include these in my previous list of *Florideae*, consequently the present list of this family bears a very different appearance from my earlier one. Dr. M. Foslie, whose early death is much to be deplored, added largely to our meagre list of Corallines, from specimens received from Dr. Setchell, who had collected some on a visit to New Zealand, and who had also received a few from myself, largely collected at Lyall Bay, Wellington. Of great importance is the *Alghe di Australia, Tasmania e Nuova Zelanda* (1923) by G. B. De Toni and Achille Forti. This contains the results of collections by the Rev. Doctor Guiseppe Capra in 1908-1909. Dr. Capra visited the Bluff, Port Chalmers, and Lyttelton, and made considerable collections of seaweeds at these places. The work is remarkable for its extensive Bibliography, and for the fact that it is the most up-to-date account we have of the New Zealand species therein described. These number about seventy-five and there are at least twelve new records.

Many other investigators have done some work on the New Zealand Algae in recent years. Perhaps I should particularly mention Dr. Cotton of the Cryptogamic Department of the British Museum at Kew. He described the seaweeds collected by Mr. W. R. B. Oliver at the Kermadecs, and has also provided a list of the Chatham Islands Algae. My own list of the Auckland and Campbell Island species was published in *The Subantarctic Islands of New Zealand* (1909). Though Dr. Skottsberg has not visited New Zealand, his work on the species of southernmost American and the adjacent antarctic lands is very valuable for the New Zealand student. For further details the Bibliography appended to this list should be consulted.

Unfortunately in Agardh's *De Alg. N.Z. mar.* no attempt has been made to refer the species to the original author, and this is true of most of my own lists. Now any New Zealand student who wishes to work at the seaweeds, would first of all have to prepare for himself a list properly dated and authenticated, and for this purpose he would have neither the literature nor the clues to this literature. I have therefore in this paper endeavoured to provide him with a standard reference list, which contains the date, and the name of the authority for each species. Fortunately we have most of the necessary literature in Christchurch, and I have been able to keep sufficiently in touch with algological work, to be sure that not very much of importance has escaped observation. The work of the early voyagers and scientists is to be found in the various Christchurch libraries; and I have in my own library a considerable collection of algological writings, including C. Agardh's *Systema Algarum*, Turner's *Fuci*, Kuetzing's *Species Algarum*, Harvey's *Phycologia Australis*,

and all the necessary works of J. Agardh. I have included in the Bibliography to this list only works consulted by me, and this will enable the student to ascertain the works on the subject actually existing in New Zealand.

Unfortunately, too, we do not possess a set of De Toni's *Sylloge Algarum* (its present price is more than £100). With it much of the labour involved in completing this paper would have been avoided. Still it is probably no bad thing that I have had to go to original sources in preparing this list. Doubtless some of the literature I should have had was not available; but it is not likely to have been very extensive. I particularly regret, however, that I did not have Dr. Cotton's "Marine Algae from North of New Zealand and the Kermadecs."* This no doubt would have provided some extra species for the list, but I hope to obtain it subsequently. For the classification of the *Chlorophyceae,* Dr. West's *Algae* vol. 1 (1916) Cambridge Univ. Press, has chiefly been depended upon; and for the genera outside the green algae, I have largely followed Engler and Prantl's *Pflanzenfamilien* (1897) Teil. 1, Abteilung 2. Dr. Oltmann's *Morphologie und Biologie der Algen* (ed. 2) has come to hand too late to be used.

Though this reference list is intended to be inclusive rather than critical, no species has been retained that has not passed a close examination by one or more good authorities, and a considerable number have been rejected because it seemed unlikely that they would be re-identified. It is of course possible that some of these will have to be reinstated. Nevertheless the list still contains over five hundred species. The New Zealand *Myxophyceae* have not been collected, and remain practically unknown. The few that have been noted appear for the sake of completenes in the list. The *Bacillariceae* have been completely omitted, as I have not studied them. Doubtless, too, there are a considerable number of the smaller brown seaweeds to be collected and described; and there are also many more parasitic species to be found, particularly amongst the *Florideae.* The list of Corallines has been much increased, but much remains to be done. Many of the reds are still insufficiently defined. In some genera at least the number of species will have to be reduced. Fragments of the same species, shewing in some cases polymorphic differences, have been described as different species. This is true at least in the genera *Gigartina, Plocamium, Nitophyllum,* and probably in other groups. Algolgists who themselves have not collected the specimens are readily deceived by differences of form due to environment. Plants growing in deep water, still water, in winter, near low tide mark, often being very different in appearance from the same species growing in shallow water, rough water, in summer, or above low tide. This has undoubtedly led to some duplication of the species, particularly in the larger genera, where the describer has not been the collector. In genera like *Ulva* and *Enteromorpha* there is still considerable uncertainty as to the limits of the species, even where they are best known; and it is little wonder therefore that there is still much to be done here amongst many of the commoner New Zealand species before their specific rank can be definitely decided.

I have endeavoured to make this paper as compact and brief as possible, and have therefore omitted nearly all synonymous names

*Through the kindness of Dr. Cotton, I have since obtained a copy.

and details of distribution. I have only given such synonyms as are necessary to connect this list with those immediately preceding it, and I have given only such details of distribution as have not been given in previous papers. For fuller synonymy and for the internal distribution of the species, reference will therefore have to be made to earlier writings. The region included in the paper, lies between the Kermadecs and the Campbell Island and includes the outlying Chatham Islands. An endemic species is therefore one not known outside that area. If only one portion of the area is mentioned then the species is known only within that part. Thus a species marked *Chathams* (Endemic) is only known from the Chatham Islands. *New Zealand* means that the species is found in the North or South Island of New Zealand or in both, but not necessarily in the outlying groups.

A word or two in conclusion may be said on the commercial value of the seaweeds. There is little doubt but that the vegetable harvests of the sea will become more and more valuable. The Maori used a few species of seaweed as a food, the Japanese cultivate certain species. Different kinds have considerable medicinal value, real or imputed. The use of seaweed has been suggested as a cure for goitre so prevalent in New Zealand. It is already an ingredient in various cough cures. Along our coasts in many places some of the larger fucoids (*Macrocystis*, but not *D'Urvillea*) are employed as valuable manures. Other more or less problematical uses have been suggested —*e.g.* for the manufacture of fuel-spirit and the production of a kind of gelatine. Whatever may be done in the future, we should at least as soon as possible endeavour to obtain some knowledge of the extent and variety of the seaweed-fields along our coasts.

Class MYXOPHYCEAE.

Family OSCILLATORIACEAE.

Genus *Lyngbya* C. Ag.

In all seas.

1. *Lyngbya aestuarii** (Mert.) Liebm. (1841.)
Bemerkninger til Danske Algeflora. p. 492. N.Z. (Bluff, Capra.)
Widely distributed.

Family NOSTOCACEAE.

Anabaena Bory. Cosmopolitan.

2. *Anabaena torulosa* (Carm.) Lagerh. (1883) Bidrag till Sveriges Algflora p. 47; de Toni et Forti (1923) p. 96.
Widely distributed.

Nostoc Bucher.

Widely distributed.

3. *Nostoc entophytum* Born. et Flah. (1888) Revision des Nostoc. hétérocyst. 4 p. 190; de Toni et Forti (1923) p. 96. In Lyngbya aestuarii, The Bluff (Capra.)
Widely distributed.

*For abbreviations see list of "Literature consulted" at end.

Family SCYTONEMACEAE.

Tolypothrix Kuetz.

Cosmopolitan.

4. *Tolypothrix irregularis* Berk. (1855) in Fl. N.Z. 2, p. 265.
   On tidal mud amongst patches of Vaucheria (Colenso.) R. L. 1.†
   Endemic.

Family RIVULARIACEAE.

Calothrix C. Ag.

Widely distributed.

5. *Calothrix confervicola* (Roth) C. Ag. (1924) Syst. Alg. p. 70; de Toni et Forti (1923) p. 96.
   Bluff on Ectocarpus and Stilophora (Capra.), Chathams. (Lemm.)
   Widely distributed.

6. *Calothrix scopulorum* (Weber et Mohr.) C. Ag. (1824) Alg. Syst. p. 70.
   Mud and rocks near high-water mark (Colenso).
   Widely distributed.

Rivularia (Roth) C. Ag.

Widely distributed.

7. *Rivularia australis* Harv. (1855) Trans. Ir. Acad. 22, p. 566; Harv. Gibson Journal of Botany June (1893). N.Z.
   This species requires re-identification.
   Australia, France.

Class CHLOROPHYCEAE.

Family BRYOPSIDACEAE.

Bryopsis Lmx.

In all temperate and warmer seas.

8. *Bryopsis plumosa* (Huds.) C. Ag. (1822) Sp. p. 448.
   A composite species, which as far as the N.Z. forms are concerned requires closer investigation.
   N.Z., Australia, Atlantic.

9. *Bryopsis vestita* J. Ag. (1877) De Alg. N.Z. mar. p. 3. R. L. 9.
   Common in tidal pools, east coast of S. Island, Wellington, and probably elsewhere, Chathams (Lemm.). Two other species of Bryopsis—one in the North and one in the South Island occur in N.Z. but are not yet sufficiently identified.
   Endemic.

Family CAULERPACEAE.

Caulerpa Lamk.

In all warmer seas.

Caulerpas reach their southernmost limit in N.Z.

10. *Caulerpa articulata* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 261; Weber van Bosse, Caulerp. p. 392. N.Z. (Colenso, Prof. T. Parker, A. Hamilton).
    Australia N.

†Laing, revised list of N.Z. Seaweeds, No. 1.

11. *Cauterpa Brownii* Endlicher 1837-45 Gen. plant. Suppl; Weber van Bosse, Caulerp. p. 306. var. *selaginoides* J. Ag. Bidr. Alg. Syst. i. p. 28. R. L. 7. N.Z. Chathams, Snares.

Australia, S. and W. Tasmania.

12. *Caulerpa hypnoides* (R. Br.) C. Ag. (1822) Sp. Alg. p. 443. R. L. 8; var. *flexilis* Lmx, (1813) Ess. p. 68, f. *Novae Zelandiae.* Weber van Bosse, Caulerp. p. 347. East Coast of North Island.

The form *Novae Zelandiae* of this polymorphic species, is close to the typical form, only a few specimens however are known from N.Z.

Australia.

13. *Caulerpa racemosa* (Forsk.) J. Ag.; var. *uvifera* J. Ag. (1872) Bidr. Alg. Syst 2, p. 35; f. *intermedia,* Weber van Bosse (1898) Caulerp. p. 363. Kermadecs (Oliver).

This form is widely distributed.

Friendly Isles, Red Sea, West Indies (Indian and Pacific Oceans).

14. *Caulerpa sedoides* (R. Br.) C. Ag. (1822) Sp. p. 438; var. *crassicaulis* J. Ag. (1872) Bidr. Alg. Syst. 1, p. 39; Weber van Bosse, Caulerp. p. 388. C. laetevirens J. Ag. Bidr. Alg. Syst. p. 34 (not of Mont. Voy. Pôle Sud. p. 14.) R. L. 6. N.Z. (Wellington, Moeraki.)

Australia, Upolu, Tonga-Tabu, Friendly Islands.

Family CODIACEAE

Codium C. Ag.

In all tropical and temperate seas.

15. *Codium adhaerens* C. Ag. (1824) Alg. Syst. p. 178. R. L. 10. N.Z. Chathams.

Almost all warmer seas.

16. *Codium Muelleri* Kuetz (1856) Tab. Phyc. 6, p. 38. t. 95. fig. 2, J. Ag. (1886) Bidr. Alg. Syst. 5, p. 45. R. L. 388, C. tomentosum, auct. nonull. partim. Kermadecs, N.Z.

Widely distributed.

17. *Codium mucronatum* J. Ag. (1886) Bidr. Alg. Syst. 5, p. 43; var. *Novae Zelandiae* J. Ag. l. c. p. 44; C. tomentosum; R. L. 11. (partim.) N.Z. Chathams.

One of the sub-species of the ubiquitous C. tomentosum, but see Chlorophyceae of N.W. America, Setchell and Gardner p. 171.

The species in one form or another is widely distributed.

18. *Codium tomentosum* Stackhouse (1801) Ner. Brit. p. 16-21 t. 7. R. L. 11 (partim). Kermadecs (Oliver, identified by A. & E. S. Gepp.)

The **forma typica** of this species is not certainly known.

All seas.

Family PHYLLOSIPHONACEAE

Ostreobium Bornet et Flahault.

19. *Ostreobium Reineckei* Born. (1896) in Rbd. Die Flora d. Samoa Ins. (Engl. Bot. Jahrb. Bd. 23. p. 296.) R. L. 390. N.Z.
Samoa, Malay Archipelago, and doubtless elsewhere.

Siphonocladus Schmitz.

In most warmer seas.

20. *Siphonocladus valonioides* (Sond.) Rbd. (1899) Meer. Alg. Investigator St. p. 41. Cladophora valonioides Sond.; R. L. 21. N.Z.
Australia, Tasmania.

Family CLADOPHORACEAE.

Cladophora Kuetz.

A cosmopolitan genus.

21. *Cladophora Aucklandica* Rabenh. (1878) Hedwigia No. 5. Auckland Islands.
Endemic.

22. *Cladophora Colensoi* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 262. R. L. 15. N.Z.
Endemic.

23. *Cladophora crinalis* Hook f. et Harv. (1855) Fl. N.Z. 2, p. 263. R. L. 12. N.Z., Stewart Id. (Lg.)
Endemic.

24. *Cladophora Daviesii* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 263. R. L. 14. N.Z.
Endemic.

25. *Cladophora fusca* Marten. Kermadecs (Meyer Island) Oliver.
Borneo.

26. *Cladophora gracilis* (Griff.) Kuetz. (1849) Sp. Alg. p. 403. R. L. 13. N.Z., Stewart Island (Lyall). Apparently not recently found.
Tasmania, Falklands, Europe, Atlantic, N. America, Japan, Alaska.

27. *Cladophora herpestica* (Mont.) Kuetz. (1849) Sp. p. 415. R. L. 20. Conferva herpestica Mont. Voy. Pôle Sud. i. p. 6. N.Z. A little known species belonging to the Agagropila section. "C'est une excellente et bien remarquable espèce." (Mont. l.c.)
Endemic.

28. *Cladophora Lyallii* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 262. t. 121. R. L. 19. N.Z. West Coast Sounds, (Lg.)
Endemic.

29. *Cladophora pacifica* (Mont.) Kuetz. (1849) Sp. p. 419. Auckland Islands.
Kerguelen, Falklands.

30. *Cladophora pellucida* (Huds.) Kuetz. (1843) Phyc. gen. p. 208. R. L. 17. N.Z.
If identifications are correct, growing in both Atlantic, and Australasian Seas.

31. *Cladophora subsimplex* Kuetz. Tab: Phyc.
Cladophora simpliciuscula Hook. f. et Harv. Fl. Ant. ii. p. 496. t. 142. (non Kuetz.) R. L. 392. N.Z.
Falklands, Malay Archipelago.

32. *Cladophora verticillata* Hook. f. et Harv. (1847) Fl. Antarct. 1. p. 193. R. L. 16. Stewart Is. Snares, Aucklands, Campbell Is.
Endemic.

Chaetomorpha Kuetz.
All Seas.

33. *Chaetomorpha Darwinii* (Hook. f. et Harv.) Kuetz. (1849) Sp. p. 380. Lychaete Darwinii, R. L. No. 24. N.Z.
Australia, Tasmania, Fuegia.

34. *Chaetomorpha linum* (Muell.) Kuetz. (1889) Sp. p. 378. Lychaete linum R. L. 23. N.Z.
Eastern U.S.A., Brazil, Europe, Red Sea, Natal, Japan, Peru etc.

35. *Chaetomorpha longearticulata* (J. Ag.) Laing. Comb. nov. Lychaete longearticulata. J. Ag. (1877) Alg. N.Z. mar. p. 2. R. L. 22. N.Z.
Endemic.

Rhizoclonium Kuetz.
Widely distributed.

36. *Rhizoclonium Africanum* Kuetz. R. L. 392. N.Z.
Distrib. (?)

37. *Rhizoclonium Hookeri* Kuetz. (1849) Sp. p. 383. ? Conferva ambigua Hook. f. et Harv. Fl. Antarct. (1849) 2, p. 494. N.Z. Snares, Aucklands, Campbell Is.
Kerguelen, Fuegia, Nicobars, Malay Archipelago.

Gomontia Bornet et Flahault.
Probably cosmopolitan.

38. *Gomontia polyrhiza* (Lagerh.) Born. et. Flah. (1888) Deux Nouv. gen. Alg. perf. p. 164. Port Chalmers (Capra.)
Widely distributed.

Family Ulvaceae

Enteromorpha (Link.) Harvey.
In all seas.

39. *Enteromorpha acanthophora* Kuetz (1849) Sp. p. 479; J. Ag. Bidr. Alg. Syst. 3, p. 157. R. L. 33. N.Z. Chathams. N.Z. is the type locality.
Tasmania, Mexico? (Setchell.)

40. *Enteromorpha bulbosa* (Suhr.) Kuetz (1849) Sp. p. 482. J. Ag. Bidr. Alg. Syst. iii. p. 139. R. L. 27. Chathams.
Tasmania, Southern Coasts of America, Africa, Kerguelen.

41. *Enteromorpha chlorotica* J. Ag. (1882) Bidr. Alg. Syst. 3, p. 136. N.Z. (De Toni et Forti., 1923, p. 85).
Australia.

42. *Enteromorpha compressa* (L) Grev. (1830) Alg. Brit. p. 180. t. 18. R. L. 29. Kermadecs, N.Z. Aucklands.
All shores.

43. *Enteromorpha flexuosa* (Wulf) J. Ag. (1882) Bidr. Alg. Syst. 3, p. 126. R. L. 393. N.Z.
Almost cosmopolitan.

44. *Enteromorpha lingulata* J. Ag. (1882) Bidr. Alg. Syst. 3, p. 143. R. L. 28. N.Z.
Tasmania, Malay Archipelago, Atlantic.

45. *Enteromorpha linza* (L) J. Ag. (1882) Bidr. Alg. Syst. 3, p. 134. t. 4. f. 10-12. N.Z. Chathams.
Tasmania, Malay Archipelago, Atlantic, Mediterranean.

46. *Enteromorpha minima* Kuetz (1849) Sp. p. 482. R. L. 34. Chathams.
Atlantic.

47. *Enteromorpha percursa* (C. Ag.) J. Ag. (1882) Bidr. Alg. Syst. 3, p. 146; var. *ramosa* J. Ag. l.c. p. 147. Entermorpha torta (Mert.) Rbd. partim. R. L. 394. This apparently is the correct name of the N.Z. form determined for me by Rbd. (v.van Goor, Die Hollaendischen Meeres Algen p. 99.) N.Z.
In one variety or another almost cosmopolitan.

48. *Enteromorpha ramulosa* Hook. (1833) Brit. Fl. p. 319. R. L. 32. N.Z.
Australia, Tasmania, Chili, Warmer Atlantic, Mediterranean, W. Indies.

Ulva (L) Wittrock.

In all seas.

49. *Ulva cornucopiae* (Kuetz.) J. Ag. (1882) Bidr. Alg. Syst. 3, p. 163. Ulva bullosa (?) Roth. R. L. 26. N.Z. A species of very doubtful authenticity as far as N.Z. is concerned, though a form similar to the above exists here, it requires much closer examination.
Probably widely distributed.

50. *Ulva lactuca* L. (1753) Sp. Plant. ii. p. 1163 (partim); Le Jolis (1880) Alg. Mar. de Cherb. A composite cosmopolitan species of which the following varieties have been recognised in N.Z.: var. *latissima* Le Jolis (1880) Alg. mar. de Cherb. p. 39. var. *rigida* C. Ag. 1822. Sp. p. 410. Kermadecs to Campbell Is.
All seas.

51. *Ulva laetevirens* Aresch (1854) Phyc. nov. p. 44. Kermadecs, (Oliver) N.Z.
Australia S., Tasmania.

52. *Ulva ligula* Mont (1849) in Kuetz. Sp. p. 476; De Toni et Forti (1923) p. 84. Ulva reticulata Mont. (1845) Voy. Pôle sud. p. 33. N.Z. Port Chalmers, (Capra.)
Torres Strait, Sumatra.

Urospora Areschoug.
Probably widely distributed in colder seas.

53. *Urospora penicilliformis* (Roth.) Aresch. (1866) Observat. Phyc. p. 15. Lyttelton (Capra.) A species of somewhat uncertain position, as it has been much confused with others.
Apparently very widely distributed.

Class PHAEOPHYCEAE.

Family ECTOCARPACEAE

Pylaiella Bory.
Widely distributed.

54. *Pylaiella ramellosa* (Kuetz.) Kuck. (1891). Beitr. zur Kentniss der Ectocarpus Arten; var. *Novae Zelandiae* Grunow (1870). Novara p. 46. N.Z. This species does not differ much from P. littoralis (L) Kjellm. Found in all temperate, and cold seas.

Ectocarpus Lyngb.
Cosmopolitan.

55. *Ectocarpus (?) pusillus* Griff. in Wyatt Alg. Danm. No. 212. R. L. 39. Of very doubtful occurrence in New Zealand. N.Z. (Colenso.)
Great Britain.

56. *Ectocarpus confervoides* (Roth.) Harv. (1855) Fl. N.Z. 2, p. 222. R. L. 40. N.Z. (Lyall.)
Widely distributed (Atlantic, Pacific, Cape of Good Hope.)

57. *Ectocarpus siliculosus* (Dillw.) Lyngb. (1819) Hyd. Dan. p. 131. t. 43. R. L. 41. N.Z.
Almost cosmopolitan in its wider significance (Australia, N. & S. Atlantic etc.)

Family SPHACELARIACEAE.

Sphacelaria Lynbg.
In all seas.

58. *Sphacelaria cirrhosa* (Roth.) C. Ag. (1824) Syst. p. 164. N.Z. (Skottsberg, Phaeoph. p. 97; Van Goor. p. 80.)
I do not know on what authority these writers include this in the N.Z. species.
Arctic, North Atlantic, Mediterranean, Japan, Australia, Fuegia.

59. *Sphacelaria implicata* Sauv. (1902). Sphacél. d'Austral. p. 2 in Notes from the Botanical School Trin. Coll. Dublin. N.Z. (Sauvageau.)
I have no description of this species. Sauv. Journ de Botanique March (1903) p. 94 places it next to S. Reinkei.
Australia (Sauv.)

Cladostephus C. Ag.

North Atlantic, Mediterranean and Australian Seas.

60. *Cladostephus verticillatus* (Lightf.) Lyngb. (1819) Hydrophyt. Dan. p. 102. t. 30 B.; Sauv. (1914.) Rermarq. sur les Sphacél. p. 601. N.Z. Bluff (Capra.)
    Australia, Tasmania.

Halopteris Kuetz.

Widely distributed.

61. *Halopteris funicularis* (Mont.) Sauv. (1903) Journ. de Bot. xvii. p. 334. Stypocaulon funiculare R. L. 42.
    N.Z. Chathams, Aucklands.
    Australia, S. Africa, South America, Falklands, South Georgia, Tristan da Cunha.

62. *Halopteris hordacea* (Harv.) Sauv. (1904) Remarques sur les Sphacél. Stypocaulon paniculatum Kuetz.; R. L. 43. N.Z.
    Tasmania, Australia and in other Southern Islands.

Anisocladus. Rke.

In South African and Australasian Seas.

63. *Anisocladus congestus.* Rke. (1890.) Uebersicht der Sphacel. p. 213. R. L. 45. N.Z.
    South Africa, Australia (?)

Ptilopogon. Rke.

An endemic genus.

64. *Ptilopogon botryocladus.* (Hook. f. et Harv.) Rke. 1890 Uebersicht der Sphacel. p. 214. Sphacelaria botryoclada Hook. f. et Harv. Fl. 2, p. 221. t. 110 B.; R. L. 44.
    Endemic.

Family ENCOELIACEAE.

Scytosiphon. C. Ag.

Widely distributed.

65. *Scytosiphon lomentarium* (Lyngb.) J. Ag. (1848.) Sp. p. 126. Chorda lomentaria, R. L. 63. N.Z. Aucklands.
    Widely distributed in all temperate and colder seas.

Colponemia Derb. et Sol.

Distribution as for species.

66. *Colponemia sinuosa* (Roth.) Derb. et Sol. (1856.) Mem. physiol. Alg. p. ii, 32. fig. 18-20. Asperococcus sinuosus, R. L. 54. N.Z.
    In all seas except the North Atlantic and North Polar.

Phyllitis Kuetz.

Widely distributed.

67. *Phyllitis fascia* (Muell.) Kuetz. (1843) Phyc. gen. p. 342. N.Z.
    The now known wide distribution negatives my previous suggestion (T.N.Z.I. 39, p. 219) that the plant might only be a guest on our shores.
    Atlantic, Arctic, Mediterranean, N. Pacific, Australia, Fuegia, Falklands.

Family DESMARESTIACEAE.

Desmarestia Lmx.

Widely distributed in colder seas.

68. *Desmarestia ligulata* (Turn.) Lmx. (1813.) Ess. p. 25. R. L. 74.

N.Z. Chathams, Aucklands.
N. Atlantic, N. Pacific, Australasia, Chile, Fuegia, S. Africa.

69. *Desmarestia Willii* Reinsch. (1890) Meeres Alg. Fl. v. S. Georgia. p. 401. D. viridis (Lmx.) Hook. f. et Harv. Fl. Antarct. ii. p. 178. Aucklands.
Fuegia, Falklands, S. Georgia, Kerguelen, Victoria Land, Franklin Is.

Family DICTYOSIPHONACEAE.

Scytothamnus Hook. f. et Harv.

Distribution as for the two species below.

70. *Scytothamnus australis* Hook. f. et Harv. (1845.) Lond. Journ. Bot. 4, p. 531. R. L. 53. N.Z. Chathams.
Australia, Fuegia, Falklands, South Georgia.

71. *Scytothamnus fasciculatus* (Hook. f. et Harv.) Cotton (1915) Cryptogams of the Falklands. p. 170. Dictyosiphon (?) fasciculatus Hook. f. et Harv. Fl. Antarct. 1, 178 t. 69. Auckland Islands.
Kerguelen, Falklands, Fuegia.

Family CHORDARIACEAE

Herponema. J. Ag.

An endemic genus.

72. *Herponema maculans* J. Ag. (1872.) Bidr. Alg. Syst. 1, p. 56. R. L. 47. N.Z. The systematic position of the genus is somewhat uncertain.
Endemic.

73. *Herponema pulvinata* (Harv.) J. Ag. (1872.) Bidr. Alg. Syst. 1, p. 56. R. L. 46. N.Z.
Endemic.

Myrionema. Greville.

Widely distributed.

74. *Myrionema strangulans* Grev. (1827.) Cryptog. Flora. t. 300. N.Z. The Bluff (Capra, on Enteromorpha linza var. crispata.) West Coast (Cotton 1909.)
Alaska. California, Europe, E. United States, West Indies, Tasmania, Falklands.

Myriocladia. J. Ag.

European, African and Australasian Seas.

75. *Myriocladia chorda* J. Ag. (1880.) Bidr. Alg. Syst. 2, p. 18. R. L. 48. N.Z.
S. Africa and S. America.

Cladosiphon Kuetz.
Widely distributed.

76. *Cladosiphon zostericola* Harv. (1863) Alg. Austr. Exsicc. No. 98; Phyc. Austr. Syn. p. 12, No. 130. N.Z. The Bluff (Capra.)
Australia, Tasmania.

Petrospongium Naegeli.
Atlantic Coasts of Europe and New Zealand.

77. *Petrospongium* (Cylindrocarpus) Berkleyi (?) (Grev.) Kuetz. (1858) Tab. Phyc. Vol. 8 t. 3. Leathesia Berkleyi Hook. f. et Harv. (partim) Fl. N.Z. ii. p. 220.
The specimens were collected by Colenso at Cape Kidnappers, and the species has not since been found here. Cotton (1909) (Kew Bulletin of Miscellaneous Information, p. 239) however re-examined Colenso's material and says, "The type of structure is the same as that of P. Berkleyi of Europe; but the filaments are more slender than in that species. It is probable that the N.Z. plant is specifically distinct from that of Europe; but further material is required before a definite statement can be made."
Europe.

Corynophlaea Kuetz.
Australia, N Z., Mediterranean.

78. *Corynophlaea Cystophorae* J. Ag. (1880.) Bidr. Alg. Syst. 2, p. 22. R. L. 49. N.Z.
Australia.

79. *Corynophlaea umbellata* J. Ag. (1880.) Bidr. Alg. Syst. 2, p. 21. R. L. 50. N.Z.
Mediterranean, Australia.

Leathesia. Gray.
Distribution as for the species.

80. *Leathesia difformis* (L) Aresch. (1846.) Phyc. Scandin. p. 376. R. L. 352. N.Z. (But see De Toni et Forti 1923, p. 79.)
Atlantic, N. America, Europe, (?) Japan, (?) Australia.

Mesogloia. C. Ag.
North Atlantic, Mediterranean and N.Z. seas.

81. *Mesogloia intestinalis* Harv. (1855) Fl. N.Z. 2, p. 220. R. L. 51. A doubtfully authentic species. N.Z. (Lyall, Lindsay.)
Endemic.

Chordaria C. Ag.
In all colder seas.

82. *Chordaria flagelliformis* C. Ag. (1823.) Syst. p. 256.
A questionable species not recently collected (v. Skottsb. Phaeophyc. p. 57.) Campbell Island (Hooker.)
Probably distinct from the Northern C. flagelliformis.

Family STILOPHORACEAE.

Stilophora J. Ag.
In Atlantic and Australasian Seas.

83. *Stilophora rhizoides* (Ehrh.) J. Ag. (1841) Symb. i. p. 6. N.Z. The Bluff (epiphytic on Chantransia corymbosa and Calothrix confervicola, Capra.)
Australia, Tasmania.

Family SPLACHNIDIACEAE.

Splachnidium. Greville.

Distribution as for species.

84. *Splachnidium rugosum* (L) Grev. 1830. Alg. Brit. syn. p. 36. R. L. 68. N.Z. Chathams.
The anatomical construction and method of reproduction and consequently the classification of this alga have been matters of much debate, and it is still urgently in need of further investigation. [v. Skottsb. 1920. Remarks on Splachnidium rugosum (L) Grev.]
Australia, Tasmania, South Africa, East Indies, New Amsterdam, Juan Fernandez.

Family SPOROCHNACEAE.

Sporochnus C. Ag.

Widely distributed.

85. *Sporochnus stylosus* Hook. f. et Harv. (1855.) Fl. N.Z. 2, p. 216. t. 109 B. N.Z. This is perhaps S. gracilis, J. Ag. Anal. Algol. cont. 3, p. 31. "Ex fragmento S. styloso ex N.Z. quod comparare licuit, hanc specimen cum nostra (S. gracilis) congruer conjicerim" (? Australia, Tasmania).

Perithalia J. Ag.

In Australasian seas.

86. *Perithalia capillaris* J. Ag. (1890) Bidr. Alg. Syst. 6, p. 5. R. L. 55. N.Z.
Endemic.

Carpomitra Kuetz.

Widely distributed.

87. *Carpomitra Cabrerae* (Turn.) Kuetz. 1843. Phyc. gen. p. 343. R. L. 66. N.Z. Chathams.
Tasmania ? (Not in Lucas' List), N. Atlantic.

88. *Carpomitra haliseris* Hook. f. et Harv. (1845) Lon. Journ. Bot. 4, p. 528. R. L. 67. N.Z. Chathams.
Probably only a form of the preceding. Endemic.

Family LAMINARLACEAE.

Adenocystis Hook. f. et. Harv.

In south temperate and sub-antarctic seas.

89. *Adenocystis utricularis* (Bory.) Skottsb. (1907.) Phaeophyc. p. 39. Adenocystis Lessonii, R. L. 55.
N.Z. Chathams, Aucklands, Campbell Is., Australia S., Tasmania, Sub-Antarctic South America, South Georgia, Kerguelen, South Orkney Is., Graham Land, South Georgia.

Ecklonia Hornemann.

Widely distributed, but chiefly in Southern Seas.

90. *Ecklonia brevipes* J Ag. (1877) Alg. N.Z. Mar p. 5. R. L. 59.
Endemic.

91. *Ecklonia buccinalis* (L) Hornem. 1828. in Act. Hafn. 3, p. 370. Aucklands (Rabenhorst.) This identification requires confirmation.
Southern Ocean, Cape of Good Hope, Falklands.

92. *Ecklonia radiata* (Turn.) J. Ag. (1848) Sp. 1, p. 146. R. L. 57. N.Z. Chathams.
The type form is of doubtful occurrence in N.Z. var. *exasperata* (Turn.) J. Ag. 1848 Sp. 1, p. 146. R. L. 58. N.Z. Chathams.
Australia, Tasmania, Chili, Cape of Good Hope, Canaries.
var. *Richardiana* J. Ag. (1848.) Sp. 1, p. 147. This seems to be the common form on the shores of N.Z. R. L. 56.
Port Philip (Areschoug, not in Lucas' List), var. *flabelliformis* (A. Rich.) J. Ag. (1848.) Sp. 1, p. 147. N.Z. (Probably endemic.) The N.Z. forms require comparison with specimens from abroad. The varieties given are probably distinct species.

Lessonia Bory.
Ochotsk Sea, N.Z. Subantarctic and Antarctic Seas.

93. *Lessonia brevifolia* J. Ag. (1894) Anal. Algol. Cont. 2, p. 88. Aucklands (collected by Capt. Fairchild, and sent to Agardh, by V. Mueller.) No doubt a good species but little known.
Endemic.

94. *Lessonia variegata* J. Ag. (1877.) Alg. Mar. N.Z. p. 6; Lg. T.N.Z.I. Vol. 26, p. 304. R. L. 61. N.Z. Snares, Aucklands, Campbell Is.
Probably distinct from the South American species, and endemic.

Macrocystis C. Ag.
Distribution as for species.

95. *Macrcystis pyrifera* (L) C. Ag. (1821.) Sp. 1, p. 47. N.Z. Chathams. R. L. 62. Aucklands, Campbell Id.
Australia, Tasmania, N.W. America to California, Galapagos Is. to Cape Horn, Cape of Good Hope.

96. *Macrocystis Humboldtii*, (Bonpl.) C. Ag. in Kunth. Syn. 1, p. 6. Aucklands (Rabenhorst.) This form has spherical bladders and small leaves.
Chili, Southern America.

Family CUTLERIACEAE.

Zanardinia Nardo.

97. *Zanardinia marginata* (Soland.) J. Ag. (1876.) Epicr., p. 534. Sunday Island (Oliver.)
N. & S. Atlantic, N. & S. Pacific, Indian Ocean.

Family FUCACEAE.

D'Urvillea Bory.
In south circumpolar seas.

98. *D'Urvillea antarctica* (Cham.) Hariot. (1892) in Notarisia 7, p. 1432. D'Urvillea utilis, R. L. 75.

N.Z., Chathams, Aucklands, Campbell Is., Cape Horn to Valparaiso, E. coast of S. America to 50 S. Lat., Falklands, South Georgia, Kerguelen Land.

Notheia Bail. et Harvey.
In Australasian seas.

99. *Notheia anomala* Bail. et Harv. (1862) Botany of the U.S. exploring expedition p. 167. R. L. 76. N.Z.
Australia.

Hormosira Endlicher.
In Australasian seas.

100. *Hormosira Banksii* (Turn.) Decaisne. (1842) Ann. Sc. Nat. Series 2, 17, p. 330. R. L. 77. Kermadecs, N.Z.
Norfolk Is., Australia, Tasmania.

Myriodesma Desne.
In Australasian seas.

101. *Myriodesma quercifolia* Bory (1829) Voy. Coquill. p. 79. N.Z. A well-defined species, but apparently not collected in N.Z. since the time of Bory, a doubtful inhabitant.
Australia.

Xiphophora Montagne.
In Australasian seas.

102. *Xiphophora chondrophylla* (R. Br.) Mont. (1842.) Ann. Sc. Nat. series 2, 18, p. 200. Fucodium chondrophyllum, R. L. 78. N.Z. Chathams, Aucklands.
Australia S.

103. *Xiphophora gladiata* (R. Br.) Mont. (1842.) Ann. Sc. Nat. Series 2, 18, p. 200. Fucodium gladiatum, R. L. 79. N.Z. Chathams, The Snares, Aucklands, Campbell Is.
Australia, Tasmania.

Phyllospora C. Ag.
In Australasian seas.

104. ??*P. Comosa* (Labill) C. Ag. is again without name of collector recorded from N.Z. (De Toni et Forti (1923, p. 71), but I feel sure it does not occur.

Scaberia Greville.
In Australasian seas.

105. *Scaberia Agardhii* Grev. (1830.) Alg. Brit. Syn. p. 26. Aucklands.

I doubt very much whether this species occurs on the coast of N.Z. I have seen no local specimens. I introduce it here because it has been reported by various early observers, and because De Toni and Forti, 1923, p. 68, refer to it as a recognised N.Z. species, though it was not collected here by Dr. Capra. It was reported from the Aucklands by Rabenhorst (1878) (Hedwigia No. 5) and may occur there.
Australia, Tasmania.

Cystoseira C. Ag.
Widely distributed.

106. *Cystoseira abrotanifolia* (Stackh.) J. Ag. (1848.) Sp. 1, p. 172. var. *macrocarpa* Kuetz. 1860. Tab. Phyc., p. 18. tab. 48. Fig. 3. N.Z. The Bluff (Capra.)
Australia.

Cystophora J. Ag.
In Australasian seas.

107. *Cystophora cephalornithos* (Labill.) J. Ag. (1848.) Sp 1, p. 246. N.Z. The Bluff (Capra.)
Australia.

108. *Cystophora distenta* J. Ag. (1870.) Alg. Chath. p. 443. R. L. 81. New Zealand, Chathams.
W. Australia.

109. *Cystophora dumosa* (Grev.) J. Ag. (1848.) Sp. 1, p. 241. R. L. 83. N.Z.
Australia.

110. *Cystophora monilifera* J. Ag. (1848.) Sp. 1, p. 241. N.Z. Chathams. (Pelorus Sound, Lg.)
Australia, Tasmania.

111. *Cystophora paniculata* (Turn.) J. Ag. (1848.) Sp. 1, p. 248. Aucklands (Rabenhorst.) Not recently collected, but may occur.
Australia.

112. *Cystophora platylobium* (Mert.) J. Ag. (1848.) Sp. 1, p. 245. R. L. 80. N.Z.
Australia, Tasmania.

113. *Cystophora retroflexa* (Labill) J. Ag. (1848.) Sp. 1, p. 242 R. L. 84. N.Z. Chathams, Aucklands.
Australia, Tasmania.

114. *Cystophora retorta* (Mert.) C. Ag. (1823.) Sp. p. 74. N.Z. Aucklands. Not recently collected, and perhaps only a form of C. retroflexa.
Australia.

115. *Cystophora torulosa* (R. Br.) J. Ag. (1848.) Sp. 1, p. 243. R. L. 85. N.Z.
Australia, Tasmania.

116. *Cystophora scalaris* J. Ag. (1870.) Alg. Chath. p. 442. R. L. 82. N.Z. Chathams.
Tasmania.

Marginaria Richard.
An endemic genus.

117. *Marginaria Boryana* (A. Rich.) Mont. (1845.) Voy. Pôle Sud. t.2 and t.3. Fig. 2. N.Z. Chathams, The Snares. R. L. 90. I am not sure that this should not be defined as M. gigas. Rich.
Endemic.

118. *Marginaria Urvilliana* A. Rich. (1832.) Voy. de l'Astrolabe. Bot. p. 10. R. L. 91. N.Z. Chathams, Aucklands.
Endemic.

Landsburgia Harv.

An endemic genus.

119. *Landsburgia quercifolia* Hook. f. et Harv. (1855.) Fl. N.Z. 2, p. 213. t. 107. R. L. 93. N.Z. Chathams, Aucklands.
Endemic.

120. *Landsburgia myricaefolia* J. Ag. (1870.) Alg. Chath. p. 448. Chathams.
Endemic.

Carpophyllum Greville.

Cape of Good Hope eastward to N.Z.

121. *Carpophyllum elongatum* (Dickie) A. & E.S. Gepp. (1911.) Journ. of Bot. Jan. p. 20. C. angustifolium, R. L. 86. Kermadecs, N.Z.
Endemic.

122. *Carophyllum macrophyllum* Mont. (1845.) Voy. Pôle Sud. 1, p. 76. Aucklands. A doubtful species not collected since D'Urville's time.
Endemic.

123. *Carpophyllum maschalocarpum* (Turn.) Grev. (1830.) Alg. Brit. Syn. p. 32. R. L. 88. Kermadecs, N.Z. Chathams, Aucklands (Type locality.)
The type species of the genus. Recorded but probably erroneously from Australia by Kjellman (Engler und Prantl's Pflanzenf. p. 286).
Endemic.

124. *Carpophyllum phyllanthus* (Turn.) Hook. f. et Harv. (1855.) Fl. N.Z. 2, p. 212. R. L. 87. Kermadecs, N.Z. Chathams.
Australia.

125. *Carpophyllum plumosum* (A. Rich.) J. Ag. (1877.) Alg. N.Z. Mar. p. 11. Sargassum plumosum A. Rich. R. L. 89. Kermadecs, Chathams, N.Z.
Endemic.

Sargassum C. Ag.

In all warmer seas.

126. *Sargassum Carpophyllum* J. Ag. (1848.) Sp. 1, p. 304. N.Z. Bluff (Capra.)
Lord Howe, Australia, Ceylon, China, Malay Archipelago.

127. *Sargassum fissifolium* (Mert.) C. Ag. (1824.) Syst. p. 303. Kermadecs (Oliver.) J. Ag. (Sp. 1, p. 339) regards this as a form of S. spinuligerum.
Queensland.

128. *Sargassum lacerifolium* (Turn.) C. Ag. (1821.) Sp. 1, p. 15. N.Z. The Bluff (Capra.)
Australia, Tasmania.

129. *Sargassum natans* (L). Borg. (1914.) Sp. Sarg. Dan. W. Indies. p. 1. Fig. 3-7. N.Z. seas (D'Urville, Lesson, Sinclair, Hochstetter.)
This is the famous gulf weed and I introduce it with some hesitation here. It has however now been found floating in so many seas, that its occurrence in the Tasman Sea and its neighbourhood is almost to be expected and there is therefore no need to doubt the records on this account, but the identification in some cases is distinctly questionable.
Atlantic, North Sea, Indian and Pacific Oceans.

130. *Sargassum Raoulii* Hook. f. et Harv. (1845.) Lond. Journ. Bot. 4, p. 523. N.Z. (Banks Pen. Raoul.)
An insufficiently known species. In R.L. 95 I have identified it with S. verruculosum. They should perhaps have been kept separate.
Tasmania.

131. *Sargassum Sinclairii* Hook. f. et Harv. (1845.) Lond. Journ. Bot. 4, p. 522. R. L. 94. N.Z. Chathams.
Endemic.

132. *Sargassum spinuligerum* Sond. (1845.) Bot. Zeitg. p. 51. N.Z. Doubtfully referred to N.Z. by J. Ag. (Alg. N.Z. mar. p. 12) but accepted as a N.Z. species by Reinbold (Algues du Siboga p. 163) and Lucas, List p. 11.
Malay Archipelago, Polynesia, Australia.

133. *Sargassum verruculosum* (Mert.) J. Ag. (1870.) Alg. N.Z. Mar. p. 12. R. L. 95. Another species of questionable occurrence in N.Z.
Australia, Tasmania.

Family DICTYOTACEAE.

Zonaria J. Ag.

Widely distributed.

134. *Zonaria Sinclairii* Hook. f. et Harv. (1845.) Lond. Journ. Bot. 4, p. 530. R. L. 72. N.Z.
Australia.

135. *Zonaria Turneriana* J. Ag. (1870.) Alg. Chath. p. 438. R. L. 71. N.Z. Chathams.
Southern Australia, Tasmania.

136. *Zonaria velutina* Hook. f. et Harv. (1855.) Fl. N.Z. 2, p. 218. N.Z.
Endemic.

Gymnosorus J. Ag.

Atlantic, Indian Ocean, Australasia.

137. *Gymnosorus nigrescens* (Sond.) J. Ag. (1894.) Anal. Algol. Cont. 1, p. 12. Zonaria nigrescens Sond. Kermadecs (Oliver.)
E. & W. Australia.

Taonia J. Ag.

North Atlantic, Mediterranean and Australasian seas.

138. *Taonia australasica* (Kuetz.) J. Ag. (1894.) Anal. Algol. Cont. 1, p. 30. Kermadecs (Oliver.)
Australia.

Dictyota Lmx.

In all warm and temperate seas.

139. *Dictyota dichotoma* (Huds.) Lmx. (1813.) Ess. p. 58. var. *implexa.* J. Ag. Anal. Algol. Cont. 1, p. 68. R. L. 395. N.Z.
Almost cosmopolitan in one variety or another.

140. *Dictyota ocellata* J. Ag. (1894.) Anal. Algol. Cont. 1, p. 68. Cotton (1909.) p. 239. Dictyota dichotoma; R. L. 70 (bis.) N.Z. (Agardh.)
Tasmania.

141. *Dictyota prolificans* A. & E.S. Gepp. 1906. Journ. Bot. p. 250. Kermadecs.
New South Wales, Queensland.

Glossophora J. Ag.

Pacific, Indian and Australasian seas.

142. *Glossophora Harveyi* J. Ag. (1880.) Bidr. Alg. Syst. 2, p. 111. R. L. 69. N.Z. Chathams.
Endemic.
(G. Kunthii also recorded from the Chathams is a Peruvian species, and unlikely to occur. It appears in T.N.Z.I. 6, p. 209, and has thence been copied into subsequent lists of Chatham Island Algae. Agardh subsequently separated the two species.)

Class RHODOPHYCEAE.

Family Bangiaceae.

Bangia Lyngbye.

In all seas.

143. *Bangia languginosa* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 264. R. L. 38. N.Z. Not recently collected.
Endemic.

Family Erythrotrichiaceae.

Erythrotrichia Aresch.

Widely distributed.

144. *Erythrotrichia ciliaris* (Carm.) Batters. (1900.) Journ. of Bot. p. 374. Bangia ciliaris Carm. R. L. 37. N.Z.
Widely distributed in Northern and Southern Seas.

Porphyra C. Ag.

In all seas.

145. *Porphyra columbina* Mont. (1845) Voy. Pôle Sud. Bot. 1, p. 33. Tab. 9. Fig. 2. R. L. 36. P. Capensis. Hook. f. et Harv. (1864) Handb. N.Z. Flora, p. 715. N.Z. Aucklands, Campbell Is. Until the genus is better understood the external distribution, if any, cannot be given.

146. *Porphyra nobilis* J. Ag. (1882) Bidr. Alg. Syst. 3, p. 62; De Toni et Forti. (1923) p. 13. R. L. 35.
N.Z. Campbell Is., Antipodes.
? Endemic (v. P. Columbina.)

147. *Porphyra perforata* J. Ag. *lanceolata.* Setchell and Hus. 1900 in Zoe Vol. 5, p. 64. N.Z. The Snares, Campbell Id. A subspecies of P. umbilicalis (P. laciniata).
Probably cosmopolitan.

148. *Porphyra subtumens* J. Ag. (nom. nud.?) R. L. 389. N.Z. (Always epiphytic on D'Urvillea.)
Endemic.

Family HELMINTHOCLADIACEAE.

Nemalion Targioni Tozzetti.

Widely distributed.

149. *Nemalion ramulosum* Hook. f. et Harv. (1855.) Fl. N.Z. 2, p. 245. R. L. 280. N.Z.
Probably endemic (and not sufficiently known.)

Chantransia (De Candolle) Schmitz.

Widely distributed.

150. *Chantransia corymbifera* Thur. 1863, in Le Jolis Alg. Mar. Cherb. p. 107. The Bluff (Capra.) On Stilophora rhizoides (De Toni et Forti 1923, p. 14.)
Widely distributed.

151. *Chantransia polyrhiza* (Lagerh.) Reinsch.; Born. et Flah. (1888.) Deux. nouv. gen. Alg. perf. p. 164. R. L. 416. Port Chalmers (Capra.)
Widely distributed.

152. *Chantransia Naumanni* Asken. (1888) in Alg. Gazelle p. 31. t. 8, fig. 13-14. Chantransia interposita Heydr. R. L. 417. N.Z. (in Codium mucronatum.)
Santiago (? Chili.)

Family CHAETANGIACEAE.

Scinaia Bivona.

In most warmer seas.

153. *Scinaia furcellata* (Turner) Bivona (1822) Fl. Vol. 1, p. 135; var. *australis,* J. Ag. 1876 Epicr. p. 712. R. L. 282.

Setchell (The Scinaia Assemblage p. 96.) doubts the existence of this species in N.Z. "It seems questionable therefore, whether there exists any species of cylindrical unconstricted Scinaia on the Australian or N.Z. Coasts." The matter must be left in abeyance until there is further opportunity to re-examine the N.Z. specimens. Setchell considers that our plant is probably only a form of Gloiophlaea scinaioides J. Ag.

S. furcellata is widely distributed.

Gloiphlaca J. Ag.
Australasian Seas.

154. *Gloiophlaea scinaioides* J. Ag. (1870) Bidr. Alg. Syst. p. 29. Epicr. 1876 p. 510. N.Z. Scinaia furcellata. R. L. 282 at least in part, v. preceding species.

Galaxaura Lmx.
In most warmer seas.

155. *Galaxaura* Sp.
Meyer Island A. & E. S. Gepp. collected also by G. H. M. S. Herald in 1884 and placed under "G. lapidescens" in Kew Herbarium. Grunow, Novara p. 76 records Galaxaura Diesingiana. Zanard. Icon. Phyc. Adriat. 1. t. 22 B.
This record requires further confirmation.

Chaetangium Kuetz.
South temperate and sub-antarctic seas.

156. *Chaetangium variolosum* (Mont.) J. Ag. (1851). Sp. p. 461. R. L. 281. N.Z. Aucklands, Campbell Id. This may be only a form of C. fastigiatum J. Ag. (v. Cotton, Cryptog. from the Falklands, p. 175).
West Australia, Fuegia, Falklands, South Georgia, Kerguelen.

Family Gelidiaceae.

Wrangelia C. Ag.
N. Atlantic and Australasian seas.

157. *Wrangelia Lyallii* Hook. f. et Harv. (1855) Fl. N.Z. 2. p. 245. R. L. 306. N.Z. Chathams. For Wrangelia squarrulosa, see Warrenia comosa, No. 428.
Endemic.

Caulacanthus Kuetz.
In most warmer seas.

158. *Caulacanthus spinellus* (Hook. f. et Harv.) Kuetz. 1849). Sp. p. 753. R. L. 290. N.Z. Chathams. Easter Id. (Borgesen, in Skottsb. Nat. Hist. of Juan Fernandez and Easter Island.).
A remarkably discontinuous distribution if correctly recorded.

Gelidium Lmx.
In most warmer seas.

159. *Gelidium caulacantheum* J. Ag. (1876) Epicr. p. 548. R. L. 286.
Endemic.

160. *Gelidium corneum* (Huds.) Lmx. (1813). Ess. p. 41. R. L. 287. N.Z. This almost cosmopolitan species has been rejected and split up by De Toni; but until the N.Z. forms are re-identified must remain here.
Atlantic, Indian and Pacific Oceans.

161. *Gelidium intricatum* (C. Ag.) Kuetz (1849). Sp. p. 767. R. L. 413. N.Z. Altogether a doubtful species.
Isle of France, Sandwich Islands.

162. *Gelidium longipes* J. Ag. Epicr. (1876) p. 547. R. L. 285. Kermadecs, N.Z.

Endemic.

Grunow, Novara p. 80 records also G. rigidum (a synonym for G. cartilagineum (L) Greville) which is quite possibly a good species.

Pterocladia J. Ag.
Widely distributed.

163. *Pterocladia capillacea* (Gmel.) Born. et Thur. Not. Alg. p. 57. t. 20. Kermadecs.

Atlantic, Mediterranean, Cape of Good Hope, Indian Ocean, China, Japan, Australasia.

164. *Pterocladia lucida* (R. Br.) J. Ag. (1851) Sp. 2, p. 483. R. L. 288. N.Z. Chathams, Little Barrier (Lg.) The type species of the genus.

Australia.

Family GIGARTINACEAE.

Iridaea Bory.
In most temperate seas.

165. *Iridaea cordata* (Turn.) J. Ag. (1851) Sp. 2, p. 254. I. micans Bory, 1828 Voy. Coq. Bot. p. 110, t. 13; Lg. 1909 Subant. Isl. of N.Z. p. 506, and perhaps synonymous with the following. Akaroa (D'Urville), Aucklands.

W. North America, Chile, Fuegia, Falklands, Crozets, Grahams Land, Victoria Land.

166. *Iridaea laminarioides* Bory (1829) Voy. Coq. Bot. p. 105 t. 11. Auckland Islands.

Chile, Fuegia, Kerguelen, N.W. America, Japan.

167. *Iridaea latissima* (Hook. f. et Harv.) Grun. 1870. Alg. Novara p. 69 t. 9, fig. 3 a-d; De Toni et Forti, 1923, p. 16. Halymenia latissima Hook. f. et Harv. (1847) Fl. Antarct. t. 73, fig. 1. Rhodoglossum latissimum J. Ag. 1876 Epicr. (partim.) R. L. 150.

N.Z., Aucklands, Campbell Id. Australia, N.W. America.

Gigartina (Stackhouse.) J. Ag.
Widely distributed.

168. *Gigartina alveata* J. Ag. (1851) Sp. 2, p. 271. R. L. 158. N.Z.

Endemic.

169. *Gigartina ancistroclada* Mont. (1845) Voy. Pôle Sud. t. 7, fig. 4. R. L. 166. N.Z.

Tasmania.

170. *Gigartina angulata* J. Ag. (1876) Epicr. p. 197. R. L. 159. N.Z. Chathams.

Endemic.

171. *Gigartina apoda* J. Ag. (1899) Anal. Algol. Cont. 5, p. 31. R. L. 172. N.Z.

Endemic.

172. *Gigartina atropurpurea* J. Ag. (1885) Bidr. Alg. Syst. 4, p. 31. R. L. 171. N.Z.
Endemic.

173. *Gigartina Chapmanni* Hook. f. et Harv. (1855.) Fl. N.Z. 2, p. 251 t. 119 B. R. L. 160. N.Z.
Endemic.

174. *Gigartina Burmanni* (C. Ag.) J. Ag. (1851) Sp. 2, p. 276. R. L. 167. A doubtful N.Z. species.
Cape of Good Hope.

175. *Gigartina circumcincta* J. Ag. (1876) Epicr. p. 202. R. L. 170. N.Z. Chathams.
Endemic.

176. *Gigartina clavifera* J. Ag. (1876) Epicr. p. 194. R. L. 154. N.Z.
Endemic.

177. *Gigartina decipiens* Hook. f. et Harv. (1855). Fl. N.Z. 2, p. 547; J. Ag. 1876 Epicr. P. 195. R. L. 164. N.Z. Chathams.
Endemic.

178. *Gigartina disticha* Sond. (1845). Bot. Zeit. p. 55. R. L. 162. N.Z.
Australia.

179. *Gigartina divaricata* Hook. f. et Harv. (1845) Fl. Ant. 1, p. 75. R. L. 151.
N.Z. Aucklands, Campbell Id.
Endemic.

180. *Gigartina flabellata* J. Ag. (1876) Epicr. p. 194. R. L. 153. N.Z.
Australia, Tasmania.

181. *Gigartina fissa* (Suhr.) J. Ag. (1876) Epicr. p. 201. R. L. 169. N.Z.
Cape Horn, Chili.

182. *Gigartina grandifida* J. Ag. (1876) Epicr. p. 199. R. L. 173. N.Z. Chathams.
Endemic.

183 ?*Gigartina insidiosa* J. Ag. (1899) Anal. Algol. Cont. 5, p. 22. R. L. 165. No locality is given by Agardh for this species, but as he previously referred it to G. pinnata, it perhaps comes from either N.Z. or Australia, or both.

184. *Gigartina Kroneana* Rabenh. (1878) Flora der Auckland Inseln, Hedwigia, 17, p. 70.
Aucklands, Campbell Id.
Endemic.

185. *Gigartina laciniata* J. Ag. (1876) Epicr. p. 194. R. L. 155.
Chathams.
Endemic.

186. *Gigartina lanceata* J. Ag. (1899) Anal. Algol. Cont. 5, p. 29. R. L. 168. N.Z.
This species requires confirmation for N.Z.
Australia.

187. *Gigartina livida* (Turn.) J. Ag. (1851) Sp. 2, p. 270. R. L. 152. Gigartina pinnata Harv. Phyc. Austr. t. 68. N.Z.
Southern Australia.

188. *Gigartina longifolia* J. Ag. (1899) Anal. Algol. Cont. 5, p. 36. R. L. 176. N.Z.
Endemic.

189. *Gigartina macrocarpa* J. Ag. (1876) Epicr. p. 683. G. pistillata Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 252. R. L. 161.

190. *Gigartina marginifera* J. Ag. (1876) Epicr. p. 196. R. L. 163. N.Z. Chathams.
Endemic.

191. *Gigartina orbitosa* J. Ag. (1899) Anal. Algol. Cont. 5, p. 36. R. L. 175. N.Z.
Endemic.

192. *Gigartina polyglotta* J. Ag. (1855) Bidr. Alg. Syst. 4, p. 29. R. L. 157. N.Z.
Endemic.

193. *Gigartina protea* J. Ag. (1855) Bidr. Alg. Syst. 4, p. 29. R. L. 156. N.Z.
Endemic.

194. *Gigartina radula* (Esp.) J. Ag. (1847) Nya Alger. fr. Mexico p. 10; Hook. f. et Harv. 1855 Fl. N.Z. 2, p. 252. N.Z. Chathams, Aucklands, Campbell Id.
California, Chili, Fuegia, Falklands, Cape of Good Hope, Kerguelen, Grahams Land.

195. *Gigartina tuberculosa* (Hook. f. et Harv.) Grunow. Chondrus tuberculosus. Hook. f. et Harv. (1847) Fl. Antarct. 1, p. 188. Aucklands (Type-locality.)
Peru, Fuegia, Chile.

196. *Gigartina rubens* J. Ag. (1899) Anal. Algol. Cont. 4, p. 34. R. L. 174. Gigartina grandifida var. latifolia J. Ag. 1876 Epicr. p. 685. N.Z. Chathams.
Endemic.

Stenogramma Harv.
Widely distributed.

197. *Stenogramma interrupta* (C. Ag.) Mont. (1846) in Duchartre Rev. Bot. p. 483. R. L. 181. N.Z. Tasmania.
Warmer Atlantic of Europe and America, California, Japan.

Gymnogongrus Martins.

In most seas.

198. ***Gymnogongrus nodiferus*** (C. Ag.) J. Ag. (1877) Alg. N.Z. mar. p. 17. G. furcellatus var nodiferus; R. L. 180.
Closely related to the Peruvian S. furcellatus.
Endemic.

Mychodea Harvey.

In Australasian Seas.

199. ***Mychodea foliosa*** (Harv.) J. Ag. (1876) Epicr. p. 573. De Toni et Forti 1923, p. 18. Gymnogongrus foliosus Harv. Phyc. Austr. t. 194. Port Chalmers (Capra.).
Australia.

Dicranema Sonder.

In Australasian Seas.

200. ***Dicranema aciculare*** J. Ag. (1876) Epicr. p. 436. R. L. 245. N.Z.
Endemic.

201. ***Dicranema Grevillei*** Sond. (1845). Bot. Zeit. p. 56. R. L. 402. N.Z.
S. and E. Australia.

Callophyllis Kuetz.

Widely distributed.

202. ***Callophyllis Calliblepharoides*** J. Ag. (1876) Epicr. p. 231. R. L. 185.
N.Z. Chathams, Auckland.
Endemic.

203. ***Callophyllis centrifuga*** J. Ag. (1876) Epicr. p. 688. R. L. 192. N.Z.
Endemic.

204. ***Callophyllis coccinea*** Harv. (1847) Alg. Tasm. p. 8, var. *carnea* J. Ag. 1876 Epicr. p. 234. R. L. 187. var. *crinalis* J. Ag. 1876 Epicr. p. 234. N.Z. Chathams.
Southern Australia, Tasmania (the type form),

205. ***Callophyllis decumbens*** J. Ag. (1876) Epicr. p. 688. R. L. 193.
Endemic.

206. ***Callophyllis depressa*** (J. Ag.) Schmitz (1897). Ectophora depressa J. Ag. Epicr. p. 690. R. L. 195.
As Schmitz has reduced the genus Ectophora to Callophyllis (Engler and Prantls Pflanzenf. p. 364) this consequential change has to be made. N.Z.
Endemic.

207. ***Callophyllis dichotoma*** (J. Ag.) Schmitz. (1887) Ectophora dichotoma J. Ag. 1876 Epicr. p. 691. R. L. 196. v. preceding species. N.Z.
Endemic.

208. *Callophyllis Hombroniana* (Mont.) Kuetz (1867). Tab. Phyc. 5. 17. t. 89. R. L. 186. N.Z. Chathams, Aucklands.
Endemic. (The ' locality—Amsterdam Id.—Botany of Novara—is probably erroneous.)

209. *Callophyllis Lambertii* (Turn.) Hook. f. et Harv. (1847) Alg. Tasm. No. 55. R. L. 188. N.Z.
Australia, Tasmania.

210. *Callophyllis tenera* J. Ag. (1849) Ofvers at K.V.A. Förhandl. p. 87. R. L. 194. N.Z. Chathams.
It may be doubted whether we have the Fuegian C. tenera here, what has been in part at least identified for it previously is Craspedocarpus erosus.
South Shetlands, Fuegia, Falklands, Kerguelen.

211. *Callophyllis variegata* (Bory.) Kuetz (1843) Phyc. gen. p. 400. t. 69. R. L. 190. N.Z. Aucklands.
Peru, Chile, Fuegia, Falklands, Kerguelen, South Orkney, Grahams Land.

Dactylymenia J. Ag.
An endemic genus.

212. *Dactylymenia Berggreni* J. Ag. (1899) Anal. Algol. Cont. 5, p. 54. R. L. 182. ? Rhodymenia ornata Mont. N.Z.
Endemic.

213. *Dactylymenia digitata* J. Ag. (1899) Anal. Algol. Cont. 5, p. 52. N.Z. R. L. 183.
Endemic.

214. *Dactylymenia Laingii* J. Ag. (1899) Anal. Algol. Cont. 5, p. 54. R. L. 184. N.Z. (Worser Bay, Lg.).
Endemic.

Ahnfeltia. Fries.
A genus of uncertain position, widely distributed in temperate and colder seas.

215. *Ahnfeltia torulosa* (Hook. f. et Harv.) J. Ag. (1876) Epicr. p. 207. R. L. 178. N.Z.
Endemic.

216. *Ahnfeltia furcata* (Hook. f. et Harv.) J. Ag. (1876) Epicr. p. 208. R. L. 179. N.Z. (Riverton, Lg.)
Endemic.

Callocolax Schmitz.
In European and N.Z. seas.

217. *Callocolax neglectus* Schmitz ex Batters (1895) Ann. Bot. 9, p. 316. R. L. 403. N.Z. Chathams, Aucklands.
Parasitic and perhaps widely distributed.

Family RHODOPHYLLIDACEAE.
Catenella Greville.
Widely distributed.

218. *Catenella oligarthra* J. Ag. (1876) Epicr. p. 587. R. L. 292. N.Z.
Endemic.

219. *Catenella opuntia* (Good and Woodw.) Grev. (1830) Alg. Brit. 166 T. 17. R. L. 291. N.Z. Var. *fusiformis* J. Ag. 1876 Epicr. p. 588. N.Z. Chathams.
N. Atlantic, Chile, Fuegia, Falklands, Indian Ocean, Australia.

Craspedocarpus Schmitz.
An endemic genus.

220. *Craspedocarpus erosus* (Harv.) Schmitz. (1897) in Engler u. Prantls Pflanzenf. p. 375.
Rhodophyllis erosa (Harv.) J. Ag. R. L. 229.
Callophyllis erosa Harv. R. L. 191.
Callophyllis tenera J. Ag. (partim) R. L. 194.
Rhodophyllis chathamensis Cotton 1907. Kew Bulletin of Miscellaneous Information No. 2, p. 40.
N.Z. Chathams.
Endemic.

Carpococcus J. Ag.
Red Sea, Indian Coasts and N.Z.

221. *Carpococcus linearis* J. Ag. (1876) Epicr. p. 586. Anal. Algol. Cont. 5, p. 46. R. L. 177.
Chathams.
Endemic.

Rhodophyllis Kuetz.
In most temperate seas.

222. *Rhodophyllis acanthocarpa* (Hook. f. et Harv.) J. Ag. (1876) Epicr. p. 364. R. L. 224. N.Z.Chathams, Aucklands.
St. Paul, New Amsterdam.

223. *Rhodophyllis angustifrons* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 247. R. L. 228. N.Z. A species that requires further examination. According to Cotton (1908) it is perhaps only an elongated form of Callophyllis coccinea Harv.
Kerguelen, Australia.

224. *Rhodophyllis Gunnii* Harv. (1845) Lond. Journ. Bot. 4, p. 540. R. L. 225. N.Z.
Australia, Tasmania.

225. *Rhodophyllis lacerata* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 247. R. L. 226. N.Z.
Endemic.

226. *Rhodophyllis Laingii* Cotton (1908) Kew Bullet. Miscell. Inform. 3. Timaru (Lg.)
Endemic.

227. *Rhodophyllis membranacea* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 448. R. L. 227. N.Z. Chathams.
Southern Australia, Tasmania.

Areschougia Harvey.
In Australasian seas.

228. *Areschougia Laurencia* Hook. f. et Harv. (1847) Lond. Journ. Bot. 6, p. 409. R. L. 405. N.Z.
Australia.

Thysanocladia Endlicher.
Australasian and Polynesian seas.

229. *Thysanocladia laxa* Sond. 1852. Linn. Vol. 25, p. 689. R. L. 404. N.Z.
Victoria.

Family SPHAEROCOCCACEAE.
Phacelocarpus Endlicher et Diesing.

230. *Phacelocarpus alatus* Harv. (1855) Trans. Ir. Acad. Vol. 22, p. 549. R. L. 408. N.Z. (Southern Otago, Lg.)
W. & S. Australia.

231. *Phacelocarpus Labillardieri* (Mert.) J. Ag. (1852) Sp. 2, p. 648; De Toni et Forti. (1923) p. 24; R. L. 230. N.Z.
Australia, Tasmania.

Melanthalia Montagne.
In Australasian seas.

232. *Melanthalia abscissa* (Turn.) Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 548. R. L. 233. N.Z.
Tasmania.

Curdiaea Harvey.
In Australasian seas.

233. *Curdiaea coriacea* (Hook. f. et Harv.) J. Ag. (1876) Epicr., p. 401. R. L. 231. N.Z.
Endemic.

234. *Curdiaea Engelharti* J. Ag. (1901) Sp. 3, part 4, p. 105. R. L. 409. N.Z.
Australia.

235. *Curdiaea laciniata* Harv. in Ann. Nat. Hist. Ser. 2, Vol. 15, p. 333. R. L. 232. N.Z.
Australia, Tasmania.

Sarcocladia Harvey.
Australasian seas.

236. *Sarcocladia (?) crateriformis* J. Ag. (1876) Epicr. p. 697. Sarcodia crateriformis; R. L. 240. N.Z.
Endemic (? Japan, Yendo.)

Gracilaria Greville.
Almost cosmopolitan.

237. *Gracilaria confervoides* (L) Grev. (1830) Alg. Brit., p. 123. R. L. 236. Kermadecs, N.Z.
Almost cosmopolitan.

238. *Gracilaria multipartita* (Clem.) J. Ag. (1852) Sp. p. 600. var. *polycarpa* (Grev.) J. Ag. Sp. 601. R. L. 239. N.Z.
Warmer Atlantic, Mediterranean, W. Indies.

239. *Gracilaria dura* (C. Ag.) J. Ag. (1852) Sp. p. 589. R. L. 237. N.Z.
West Indies, Europe, Mediterranean, India.

240. ***Gracilaria flagellifera*** J. Ag. (1876) Epicr. p. 412. R. L. 235. Chathams (von Mueller). This appears first as a nomen nudum, T.N.Z.I. 6, p. 209.
Endemic.

241. ***Gracilaria Harveyana*** J. Ag. (1885) Bidr. Alg. Syst. 4, p. 59. R. L. 234 and 411. N.Z. Chathams.
S. & W. Australia.

242. ***Gracilaria lichenoides*** (L) Harv. (1844) Lond. Journ. Bot. 3, p. 445; J. Ag. 1901. Sp. 2, part 4, p. 52. R. L. 410. This is reported from N.Z. by Agardh (loc. cit.), but no collector's name is given.
New Guinea, Australia, Tasmania, Indo-China.

243. ***Gracilaria polycarpa*** (Harv.) J. Ag. (1901) De Florid. Mant., p. 89. N.Z. (von Mueller.) Yendo (Notes on Algae New to Japan 6, p. 83) thinks that this on re-examination may turn out to be only a form of the variable Sarcodia Montagneana.
Endemic.

244. ***Gracilaria ramulosa*** J. Ag. (1876) Epicr. p. 417. R. L. 242. N.Z.
S.E. Australia.

245. ***Gracilaria secundata*** Harv. (1863) Phyc. Austral. Syn. No. 432. R. L. 238. N.Z. A doubtful species.
S.E. Australia.

Calliblepharis Kuetz.

North Atlantic, Mediterranean, and Australasian seas.

246. ***Calliblepharis (?) prolifera*** (Hook. f. et Harv.) J. Ag. (1876) Epicr. p. 432. R. L. 243. Rhodymenia prolifera Hook. f. et Harv. N.Z.
Endemic.

Hypnea Lmx.

In most warmer seas.

247. ***Hypnea musciformis*** (Wulf.) Lmx. (1813) Ess. p. 43; Hooker (1867) Handb. N.Z. Fl. p. 689. N.Z.
Australia, Tasmania, Cape of Good Hope, Red Sea, Indian Ocean, Warmer Atlantic.

Apophlaea Harvey.

Endemic genus of uncertain position.

248. ***Apophlaea Sinclairii*** Harv. (1855) Fl. N.Z. 2, p. 244. t. 116. B. R. L. 283. N.Z. Stewart Is., Campbell Is., The Snares.

249. ***Apophlaea Lyallii*** Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 244. t. 116A. R. L. 284. N.Z., Chathams.
Endemic.

Sarcodia J. Ag.

250. ***Sarcodia Montagneana*** J. Ag. (1852) Sp. 2, p. 623. R. L. 241. N.Z. Chathams.
S. Georgia, Australia, Japan.

Family RHODYMENIACEAE.

Gloiohymenia J. Ag.

Distribution as for species.

251. *Gloiohymenia ornata* (Mont.) J. Ag. (1899) Anal. Algol. Cont. 5, p. 57. Rhodymenia ornata Mont. Voy. Pôle. sud. p. 160. Aucklands (D'Urville.)
Australia.

Fauchea Mont. et Bory.

252. *Fauchea coronata* (Harv.) J. Ag. (1876) Epicr. p. 294. Callophyllis coronata Harv. (1859) Phyc. Austr. t. 97. R. L. 200. N.Z.
Australia.

Hymenocladia J. Ag.

In Australasian seas.

253. *Hymenocladia lanceolata* J. Ag. (1870) Alg. Chath. p. 449. R. L. 206. N.Z. Chathams. Perhaps not specifically distinct from the following.
Endemic.

254. *Hymenocladia polymorpha* (Harv.) J. Ag. (1870) Alg. Chath. p. 453; Epicr. (1876) p. 315; De Toni et Forti (1923) p. 29. Rhodymenia polymorpha Harv. (1860) Phyc. Austr. t. 157. Chathams.
Australia, Tasmania.

Rhodymenia (Grev.) J. Ag.

Widely distributed.

255. *Rhodymenia corallina* (Bory.) Grev. (1830) Alg. Brit. p. 48. R. L. 211. A species of questionable identity, as far as N.Z. is concerned. N.Z. Chathams (von Mueller), Aucklands.
Australia (?), Southern Chile, Fuegia, Falklands.

256. *Rhodymenia dichotoma* Hook. f. et Harv. (1845) Fl. Antarct. 1, p. 186, t. 72. N.Z. Aucklands, Campbell Is. A doubtful species (v. J. Ag. Epicr. p. 236.)
Endemic.

257. *Rhodymenia foliifera* Harv. (1867) Phyc. Austr. Syn. No. 508; J. Ag. (1876) Epicr. p. 331. This is given as an N.Z. species on the authority of Agardh. l.c.
Australia, Tasmania.

258. *Rhodymenia linearis* J. Ag. (1841) Symb. 1, p. 13. N.Z. Aucklands, Campbell Is.
Australia, Tasmania.

259. *Rhodymenia leptophylla* J. Ag. (1877) Alg. N.Z. mar. p. 20. R. L. 210. N.Z. Chathams.
Endemic.

260. *Rhodymenia palmata* (L) Grev. (1830) Alg. Brit. p. 93; De Toni et Forti (1923) p. 29. Port Chalmers (Dr. Capra.) A widely distributed, and somewhat polymorphic species. Dr. Capra's specimens are sterile.

261. ***Rhodymenia sanguinea*** Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 248; De Toni et Forti, (1923) p. 30. Port Chalmers (Capra.) Foveaux St. (Lyall.)
Endemic.

Epymenia Kuetz.

South African and Australasian seas.

262. *Epymenia acuta* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 249; J. Ag. Anal. Algol., p. 92. R. L. 214. Questionably distinct from E. Wilsonis. N.Z.
Endemic.

263. *Epymenia obtusa* (Grev.) Kuetz. (1849) Sp. p. 787. Chathams (von Mueller.) A somewhat doubtful N.Z. species.
Cape of Good Hope.

264. *Epymenia Wilsonis* Sond. (1853) Linn. p. 516; R. L. 213. N.Z. Chathams, Aucklands. Perhaps not different from E. obtusa.
Australia.

Sebdenia (Berthold.)

In most warmer seas.

265. *Sebdenia (?) kallymenioides* (Harv.) De Toni (1900) Syll. Alg. 4, p. 533; De Toni et Forti (1923) p. 31. Halymenia kallymenioides Harv. (1855) Trans. Tr. Acad. 22, p. 586. Port Chalmers (Capra.)
Borneo, Australia.

Chrysymenia J. Ag.

In all warmer seas.

266. *Chrysymenia asperata* (Hook. f. et Harv.) Cotton (1909) p. 241. Chrysymenia (?) apiculifera J. Ag. 1876. Epicr. p. 320. Callophyllis asperata Hook. f. et Harv. Fl. N.Z. 2, p. 250. R. L. 189.
Endemic.

267. *Chrysymenia (?) polydactyla* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 253. t. 119A. R. L. 209. N.Z.
The genus is quite doubtful, and the plant has not been recently collected.
Endemic.

268. *Chrysymenia saccata* J. Ag. (1899) Anal. Algol. Cont. 5, p. 89. R. L. 207. N.Z.
Endemic.

Champia Desvaux.

All warmer and temperate seas.

269. ***Champia Novae Zelandiae*** Hook. f. et Harv. Lond. Journ. Bot. 4, p. 541. R. L. 204. N.Z. Chathams. Var. *tumescens* Lg. (1902) T.N.Z.I. p. 338. N.Z.
Endemic.

Chylocladia (Grev.) Thuret.

In most warmer seas.

270. *Chylocladia secunda* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 253. R. L. 201. N.Z.
Perhaps only a variety of the European C. uncinata.
Endemic. (? Mediterranean, Atlantic.)

271. *Chylocladia umbellata* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 253. t. 119C. R. L. 202. Yendo (Notes on Algae new to Japan 5, p. 259) places this under the genus Lomentaria.
Australia, Southern Japan.

Plocamium (Lmx.) Lyngbye.

On all Coasts.

272. *Plocamium angustum* J. Ag. (1841) Symb. 10; Epicr. p. 343. R. L. 219. N.Z. Chathams.
Australia, Tasmania.

273. *Plocamium abnorme* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 543. R. L. 217. N.Z., Chathams.
Endemic.

274. *Plocamium brachiocarpum* Kuetz. (1849) Sp. p. 885. R. L. 216. Kermadecs, N.Z. Chathams, Aucklands, Campbell Id., Yendo (Notes on Algae new to Japan 3, p. 543) proposes to reduce P. brachiocarpum. P. abnorme, P. angustum to the one species. P. Telfairiae (Harv.) J. Ag. and he is possibly right in so doing; but I hesitate to follow him without further examination of my specimens.

275. *Plocamium coccineum* Lyngbye (1819) Tent. Hydroph. Danic. p. 39. t. 9. N.Z. Chathams, Aucklands, Campbell Is.
Most temperate seas.

276. *Plocamium costatum* J. Ag. (1841) Symb. p. 10. R. L. 220. Probably a composite species. N.Z., Chathams (Reinbold).
Australia, Tasmania, Japan.

277. *Plocamium cruciferum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 246. R. L. 222. N.Z., Chathams, Aucklands.
Endemic.

278. *Plocamium dilatatum* J. Ag. (1876) Epicr. p. 347. R. L. 223. N.Z.
Tasmania.

279. *Plocamium dispermum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 246. R. L. 218. N.Z.
Endemic.

280. *Plocamium leptophyllum* Kuetz. (1849) Sp. p. 885; R. L. 215. N.Z. Chathams. Lucas (Algae of Commonwealth Bay, p. 14) considers this as only a form of P. coccineum.
Australia, Tasmania, Antarctic.

281. *Plocamium procerum* J. Ag. (1841) Symb. p. 10. R. L. 407. N.Z.
Australia, Tasmania.

282. *Plocamium rigidum* J. Ag. (1851) Sp. p. 397. R. L. 221. Major Reinbold doubtfully identified a N.Z. plant with this species from the Cape of Good Hope.

Family DELESSERIACEAE.

Martensia Hering.

In subtropical seas.

283. *Martensia elegans* Hering (1842) Ann. of Nat. Hist. Ser. 1, 8, p. 92. Kermadecs (Oliver.)
South Africa, W. Australia, New South Wales.

Nitophyllum Greville.

In all seas.

284. *Nitophyllum affine* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 447. R. L. 263. N.Z.
Australia, Tasmania.

285. *Nitophyllum Berggrenianum* J. Ag. (1876) Epicr. p. 449. R. L. 246. N.Z.
Endemic.

286. *Nitophyllum ciliolatum* Harv. Trans. Ir. Acad. 22, p. 549. By some authors this has been regarded as only a variety of N. uncinatum (Turn.) J. Ag.; but Yendo, 1918 (Notes on Algae new to Japan, p. 68) considers it sufficiently distinct. N.Z.
W. Australia, Japan.

287. *Nitophyllum decumbens* J. Ag. (1876) Epicr. p. 458. R. L. 251. Kermadecs (Oliver) N.Z. var. *fucicola* J. Ag. (1876) l.c., p. 459. N.Z.
Endemic.

288. *Nitophyllum denticulatum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p 241. R. L. 250. N.Z.
Endemic.

289. *Nitophyllum dilabidum* J. Ag. (1885) Bidr. Alg. Syst. 4, p. 67. R. L. 261. N.Z.
Endemic.

290. *Nitophyllum d'Urvillei* (Bory) J. Ag. (1851) Sp. 2, p. 666. A doubtful species for N.Z.
Chili to Fuegia, Falklands.

291. *Nitophyllum Gattyanum* J. Ag. (1876) Epicr. p. 454. R. L. 248. A Tasmanian species, doubtfully occurring in N.Z.

292. *Nitophyllum Harveyanum* J. Ag. (1876) Epicr. p. 462. N.Z. (Seacliff, Lg.).
Endemic.

293. *Nitophyllum laciniatum* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 256; J. Ag. Epicr. p. 454. N.Z. A species of doubtful identity and habitat but see under N. variolosum.
(Islands of the Antarctic Ocean. J. Ag.)

294. *Nitophyllum ? microphyllum* (Smith) Laing (1902) T.N.Z.I. p. 34, p. 345. R. L. 262. Generic position doubtful. N.Z.
Endemic.

295. *Nitophyllum minus* (Sond.) J. Ag. (1876) Epicr. p. 467. R. L. 259. N.Z.
Australia.

296. *Nitophyllum multinerve* Hook. f. et Harv (1845) Lond. Journ. Bot. 4, p. 155. R. L. 258. N.Z. Aucklands.
Tasmania, Chile, Cape Horn, Falklands, S. Georgia.

297. *Nitophyllum palmatum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 240 (var. excel.) R. L. 254. N.Z., Chathams (von Mueller).
Endemic.

298. *Nitophyllum parvifolium* J. Ag. (1876) Epicr. p. 457. R. L. 412. N.Z.
Victoria.

299. *Nitophyllum pleurosporum* (Hook. f. et Harv.) Laing. comb. nov. Delesseria pleurospora Harv. (1855) Fl. N.Z. 2, p. 239. Pteridium pleurosporum. R. L. 269. Skottsb. Rhodophyc. p. 47. Brings this plant to the genus Nitophyllum under the name N. condensatum (Reinsch.) Skottsb., but surely the earlier specific name of Harvey should stand. N.Z.
Fuegia.

300. *Nitophyllum polyglossum* J. Ag. (1898) Sp. Vol. 3, part 3, p. 79. R. L. 255. N.Z.
Endemic.

301. *Nitophyllum semicostatum* J. Ag. (1876) Epcir. p. 699. R. L. 256. N.Z.
Endemic.

302. *Nitophyllum Smithii* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 256. R. L. 260. N.Z. Chathams.
Falklands.

303. *Nitophyllum uncinatum* (Turn.) J. Ag. (1852) Sp. 2, p. 654; Cotton (1909), p. 242. R. L. 252. N.Z.
Australia, Mediterranean and warmer Atlantic.

304. *Nitophyllum (?) undulatissimum* J. Ag. (1898) Sp. 3, part 3, p. 59. N.Z.
Endemic.

305. *Nitophyllum variolosum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 241; Cotton (1909), p. 241. R. L. 247. N.Z. Cotton (Crypt. Falk., p. 201) states that a N.Z. specimen thus named by J. Ag. in the Brit. Mus. is N. laciniatum Hook. f. et Harv.
Endemic.

Platyclinia J. Ag.
Australasian and Fuegian seas.

306. *Platyclinia (?) crispatum* (Hook. f. et Harv.) J. Ag. (1898) Sp. 3, p. 3, p. 110. Nitophyllum crispatum Hook. f. et Harv. Fl. Antarct. 1, p. 185, t. 21. Aucklands, Campbell Is.

Abroteia Harvey.
An endemic Genus.

307. *Abroteia orbicularis* (Harv.) J. Ag. (1876) Epicr., p. 694. R. L. 205. N.Z.
Endemic.

Apoglossum J. Ag. (1898.)
Widely distributed.

308. *Apoglossum Montagneanum* J. Ag. (1898) Sp. 3, part 3, p. 194. R. L. 272. N.Z.
Endemic.

309. *Apoglossum oppositifolium* (Hook. f. et Harv.) J. Ag. (1898) Sp. 3, part 3, p. 193. R. L. 271. N.Z.
Endemic.

310. *Apoglossum ruscifolium* (Turn.) J. Ag. (1898) Sp. 3, part 3, p. 194; Skottsb. Rhodophyc. p. 27. R. L. 271. N.Z.
Northern Atlantic, Mediterranean.

Hemineura Harvey.
In Australasian seas.

311. *Hemineura cruenta* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 240. R. L. 270. N.Z.
Endemic.

Delesseria Imx.
Almost cosmopolitan.

312. *Delesseria crassinervia* Mont. (1845) Voy. Pôle Sud. p. 164, t. 8, f. 1. R. L. 276; Skottsb. Rhodophyc. p. 22. N.Z. Chathams, Aucklands, Campbell Is. An imperfectly known species.
Perhaps endemic.

313. *Delesseria (Paraglossum) lancifolia* (Hook. f. et Harv.) J. Ag. (1898) Sp. 3, part 3, p. 217. Delesseria lancifolia J. Ag. (1872) p. 79. N.Z.
North America, Fuegia, Falklands.

314. *Delesseria Leprieurii* Mont. (1844) Ann. Sc. Nat. Ser. 3, vol. 13, p. 96, t. 5, f. 1. Calaglossa Leprieurii J. Ag. Epicr. p. 499. R. L. 277. N.Z. The Australasian species may not be identical with the American.
Australia, Guiana, Ceylon, Atlantic, Coasts of America.

315. *Delesseria nereifolia* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 238. R. L. 275. N.Z. Not recently collected, and little known.
Endemic.

Phycodrys Kuetzing.
Widely distributed.

316. *Phycodrys Quercifolia* (Bory.) Skottsb. (1923) Rhodophyc, p. 35. Schizoneura quercifolia; R. L. 267. N.Z.
(The genus Phycodrys is amalgamated with Delesseria by Schmitz in Engler and Prantl's Pflanzenf. p. 412.)
Southern America, Fuegia.

Schizoneura J. Ag.
In N.Z. and Fuegian Seas.

317. *Schizoneura Davisii* (Hook. f. et Harv.) J. Ag. (1898) Sp. 3, Part 3, p. 168. R. L. 265. According to Skottsb. Rhodophyc. p. 36 and p. 50, this probably belongs to the genus Nitophyllum and is possibly a state of N. pleurosporum (N. condensatum Reinsch.). N.Z.
Chili, Cape Horn.

318. *Schizoneura dichotoma* (Hook f. et Harv.) J. Ag. (1898) Sp. 3, part 3, p. 168. R. L. 264.
Foveaux St., Aucklands, Campbell Is., Chathams. Kerguelen, St. Paul Is. ? Australia.

319. *Schizoneura Hookeri* (Hook. f. et Harv.) J. Ag. (1898) Sp. 3, part 3, p. 168. R. L. 266. N.Z. Genus doubtful, indeed it may be questioned, whether Schizoneura should not be amalgamated with Delesseria.
Endemic.

320. *Schizoneura laurifolia* J. Ag. (1898) Sp. 3, part 3, p. 168. R. L. 268. N.Z.
Endemic.

Phitymophora J. Ag.
In Australasian seas.

321. *Phitymophora linearis* Lg. comb. nov.; P. Laingii. J. Ag. (1898) Sp. 3, part 3, p. 173. Delesseria linearis Lg. T.N.Z.I. vol. 29, p. 449. R. L. 274. N.Z. (a rare species.)
Endemic.

Family BONNEMAISONIACEAE.

Ptilonia J. Ag.
In Australasian and Fuegian seas.

322. *Ptilonia magellanica* (Mont.) J. Ag. (1852) Sp. p. 774. R. L. 302. The occurrence of this Fuegian Sp. in N.Z. requires confirmation.
Fuegia, Falklands, Kerguelen, Graham Is.

Delisea Lmx.
Australasian seas.

323. *Delisea elegans* (C. Ag.) Hook f. et Harv. (1844) Lond. Journ. Bot. 3, p. 442. R. L. 304. N.Z.
S. & E. Australia, Tasmania.

324. *Delisea pulchra* (Grev.) Mont. (1844) Ann. Sc. Nat. Ser. 3. Vol. 1, p. 158. R. L. 305. Kermadecs, N.Z.
Australia, Tasmania, South Georgia, Grahams Land.

Asparagopsis Montagne.
Widely distributed in warmer seas.

325. *Asparagopsis armata* Harv. (1855) Trans. Ir. Acad. Vol. 22, p. 544. R. L. 303. N.Z. Chathams.
Tasmania, Australia.

326. *Asparagopsis Sandfordiana* Harv. (1855) Trans. Ir. Acad. Vol. 22, p. 544. Kermadecs (Oliver.)
W. Australia, Queensland.

Rhodomelaceae

Laurencieae.

Laurencia Lmx.

Widely distributed.

327. *Laurencia botrychioides* Harv. (1855) Fl. N.Z. 2, p. 234. R. L. 498. N.Z. Chathams.
A doubtful species, J. Ag. Epicr., p. 657, considers it may be a juvenile form of L. distichophylla, not to be confused with L. botryoides Gaill.
Endemic.

328. *Laurencia distichophylla* J. Ag. (1852) Sp. p. 762. R. L. 295. N.Z.
Australia, Japan, Cape of Good Hope.

329. *Laurencia elata* Harv. (1847). Ner. Austr., p. 81, t. 33. R. L. 297. N.Z.
Australia, Tasmania.

330. *Laurencia Forsteri* (Mert.) Grev. (1830) Syn., p. 2. Kermadecs (Oliver).
S. & W. Australia, Tasmania.

331. *Laurencia gracilis* Harv. (1847) Nereis. Austr., p. 84. R. L. 293. N.Z. Chathams.
Endemic.

332. *Laurencia hybrida* (Dcsne) Kuetz. (1849) Sp. p. 586. R. L. 299. N.Z. A doubtfully distinct species apparently not recognised by Falkenb., possibly only a form of L. pinnatifida.
Widely distributed in Australian and European Seas.

333. *Laurencia heteroclada* Harv. (1855) Trans. Ir. Acad. vol. 22, p. 544. R. L. 299A. N.Z. Chathams. The species in this genus badly require redetermination from the types.
S. and W. Australia, Japan.

334. *Laurencia pinnatifida* (Gmel.) Lmx. (1813) Ess. p. 42. Aucklands (Harvey).
Europe, Mediterranean, Red Sea, Africa, Cape Horn, Japan, Hawaii.

335. *Laurencia obtusa* Lmx. (1813) Ess. p. 42. Chathams (Cotton).
In almost all tropical and temperate seas.

336. *Laurencia thyrsifera* J. Ag. (1876) Epicr. p. 654. R. L. 296. Chathams.
Endemic.

337. *Laurencia virgata* (C. Ag.) J. Ag. (1852) Sp. p. 752. R. L. 294. N.Z.
Australia ? (not in Lucas' List) Cape of Good Hope.

Janczeweskia Solms-Laubach.
Warmer Seas.

338. *Janczeweskia* sp. (Schmitz.) Fkbg. (1901) p. 257 records a species parasitic on Chladhymenia oblongifolia found by Schmitz.
Endemic.

Sub-family CHONDRIEAE.

Cladhymenia Harvey.

Australasian Seas, and one species from the Antilles.

339. *Cladhymenia oblongifolia* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 540. R. L. 301. N.Z. Chathams. The type species of the genus.
Endemic.

340. *Chladhymenia Lyallii* Harv. (1847) Ner. Austral. 87, t. 33. R.L. 300. N.Z.
Endemic.

Chondria (C. Ag.) Harvey.

In all warmer seas.

341. *Chondria angustata* (Hook. f. et Harv.) Kylin (1919) ex Kylin and Skottsb. Rhodophyc. p. 52. Laurencia pinnatifida Lmx. var. angustata Hook. f. et Harv. Fl. Ant. 1, p. 484. Auckland Islands. A species that requires re-identification for N.Z.
Fuegia, Falklands.

342. *Chrondria capènsis* (?) (Harv.) Falkb. (1901) p. 720. Chondriopsis capensis. R. L. 310. N.Z.
Cape of Good Hope.

343. *Chondria debilis* Harv. (1863) Syn. Austr. Alg. No. 206. Chondriopsis debilis. J. Ag. Anal. Algol. p. 155. Port Chalmers (Capra.)
Australia, Tasmania.

344. *Chondria flagellaris* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 224. Chondriopsis flagellaris. R. L. 308. N.Z. As Falkenb. has reduced the genus Chondriopsis to be a section of Chondria, the name must be altered as above.
Endemic.

345. *Chondria macrocarpa* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 223. Chondriopsis macrocarpa; R. L. 309. N.Z. Chathams.
Endemic.

Sub-family POLYSIPHONIEAE.

Lophurella Schmitz.

Australasian and Sub-Antarctic seas.

346. *Lophurella caespitosa* (Hook. f. et Harv.) Fkbg. (1901) p. 155. Rhodomela caespitosa; R. L. 318. N.Z.
Endemic.

347. *Lophurella comosa* (Hook. f. et Harv.) Fkbg. (1901) p. 158, t. 19, f. 31. Rhodomela comosa Hook. f. et Harv. (1845) London Journ. 4, p. 263. Mazza (La Nuova Notarisia, April 1909, p. 75) has thus identified a plant sent him by me from Lyttelton. N.Z.
Falklands.

348. *Lophurella Hookeriana* (J. Ag.) Fkbg. (1901), p. 158. Rhodomela Gaimardi, R.L. 310. Rhodomela Hookeriana; R. L. 415. N.Z.
S. Australia, Fuegia, Falklands, Kerguelen.

Polysiphonia Greville.
In all seas.

349. *Polysiphonia aterrima* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 536. R. L. 334. N.Z. Chathams.
Endemic.

350. *Polysiphonia Blandi* Harv. (1862) Phyc. Austr. 4, t. 184. R. L. 349. N.Z. This species requires re-identification.
Australia.

351. *Polysiphonia cancellata* Harv. (1844) Lond. Journ. Bot. 3, p. 440. R. L. 340. N.Z.
Tasmania, Australia.

352. *Polysiphonia caulescens* J. Ag. (1896) Anal. Algol. Cont. 3, p. 3. R. L. 352. N.Z. Chathams.
Endemic.

353. *Polysiphonia comoides* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 231. R. L. 331. N.Z.
Endemic.

354. *Polysiphonia corymbifera* C. Ag. (1822) Sp. p. 90. R. L. 332. N.Z.
S. Africa.

355. *Polysiphonia dumosa* Hook. f. et Harv. (1845) Fl. Antarct. 1, p. 182, t. 75, fig. 1; (1845) Lond. Journ. Bot. 4, p. 268. R. L. 347. Campbell Island (Hooker), Chathams (Reinbold). A doubtful species. The genus requires re-investigation.
Endemic.

356. *Polysiphonia Frutex* Hook. f. et Harv. (1844) Lond. Journ. Bot. 3, p. 439. R. L. 348. Polysiphonia decipiens Mont. (1845) Voy. Pôle. Sud. Bot. 1, p. 131; Fkbg. 1901, p. 126. R.L. 333. N.Z. Aucklands.
Australia, Tasmania.

357. *Polysiphonia Hookeri* Harv. (1847) Ner. Austr. p. 40. R. L. 342. N.Z.
Australia, Tasmania.

358. *Polysiphonia Hystrix* Hook. f. et Harv. (1847) Ner. Austr. p. 41, t. 14. R. L. 343. N.Z.
Australia, Tasmania.

359. ***Polysiphonia implexa*** Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 538; Fkbg. (1901) p. 722; R. L. 338. N.Z.
W. Australia.

360. ***Polysiphonia infestans*** ? Harv. (1855) (Mar. Bot. of W. Austr., p. 539) Trans. R. Ir. Acad. 22; R. L. 351. N.Z.
Australia.

361. ***Polysiphonia isogona*** Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 231. R. L. 330. N.Z.
Endemic.

362. ***Polysiphonia Lyallii*** Hook. f. et Harv. (1847) Fl. Antarct. 1, p. 182, t. 74; Fkbg. (1901) p. 143. R. L. 329. N.Z. Aucklands, Chathams.
Endemic.

363. ***Polysiphonia Mallardiae*** (Harv.) J. Ag. (1852) Sp. p. 1020. R. L. 341. N.Z.
Tasmania, Australia.

364. ***Polysiphonia microcarpa*** Hook. f. et Harv. (1845.) Lond. Journ. Bot. 4, p. 265. Polysiphonia abscissa; R. L. 326. Skottsb. Rhodophyc., p. 55, points out the name ***microcarpa*** has priority. N.Z.
S. Australia, Cape Horn, Fuegia, Falklands, Kerguelen, Grahams Land.

365. ***Polysiphonia mollis*** Hook. f. et Harv. (1847) Ner. Austr. p. 43. Polysiphonia tongatensis Harv. The Bluff (Capra.)
Australia, Tasmania, Sandwich Isl., Tongatabu, New Guinea.

366. ***Polysiphonia Muelleriana*** J. Ag. (1870) Alg. Chath., p. 455. R. L. 337. N.Z. Chathams (Riverton, Lg.)
Endemic.

367. ***Polysiphonia ramulosa*** Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 230. R. L. 335. N.Z. Chathams.
Endemic.

368. ***Polysiphonia roeana*** Harv. (1855) Trans. R. Ir. Acad. 22, p. 540. R. L. 329. N.Z. This species requires re-identification for N.Z.
W. Australia.

369. ***Polysiphonia strictissima*** Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 538. R. L. 327. N.Z. Chathams. The genus requires re-identification.
Endemic.

370. ***Polysiphonia variabillis*** Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 228. R. L. 328. N.Z. Chathams (Reinbold). The genus requires re-identification.

371. ***Polysiphonia virgata*** (C. Ag.) Fkbg. (1901) p. 146. Polysiphonia Gaudichaudii; C. Ag. Sp. 62. R. L. 344. N.Z. This species requires further comparison with Cape of Good Hope and W. Australian plants.
Cape of Good Hope, West Australia.

Metamorphe Fkbg.
As for species.

372. *Metamorphe Colensoi* (Hook. f. et Harv.) Fkbg. (1897) in Engler and Prantl's Pflanzenf. p. 445. Polysiphonia Colensoi Hook. f. et Harv. Fl. N.Z. 2, t. 112, C. R. L. 322. N.Z. Chathams.
Sandwich Islands (Mazza.).

Aphanocladia Fkbg.
Australasian Seas.

373. *Aphanocladia delicatula* (Hook. f. et Harv.) Fkbg. (1897) in Engler and Prantl's Pflanzenf. p. 444. Rytiphaea delicatula; R. L. 354. The type species of the genus. N.Z.
Australia (Lucas).

Symphocladia Fkbg.
Japan, China to N.Z.

374. *Symphocladia marchantioides* (Hook. f. et Harv.) Fkbg. (1897) in Engler and Prantl's Pflanzenf. p. 444 (1901) Die Rhodomel. p. 277. Placophora marchantioides J. Ag. R. L. 357. N.Z.
N. Australia, Japan.

Pterosiphonia Fkbg.
Widely distributed.

375. *Pterosiphonia cloiophylla* (C. Ag.) Fkbg. (1901) p. 271. Polysiphonia cloiophylla; R. L. 345. N.Z. Var. *corymbosa* Kuetz. (1849) Sp. p. 844. N.Z.
Australia, Cape of Good Hope, St. Paul, New Amsterdam.

376. *Pterosiphonia simplicifilum* (J. Ag.) Laing. comb nov. Polysiphonia simplicifilum J. Ag. R. L. 324. N.Z.
Endemic.

377. *Pterosiphonia pinnata* (Roth) Fkbg. (1901) p. 263. Polysiphonia pennata (Roth) J. Ag. R. L. 325.
This is a characteristic Mediterranean species, and Fkbg. (l.c.) throws some doubt on the identity of our plant with it, but admits that he has seen fragments of a similar Pterosiphonia from many parts of the world.
Australia, Mediterranean.

Sub-family Lophothalieae.

Brogniartella Bory.
Widely distributed in warmer seas.

378. *Brogniartella australis* (C. Ag.) Schmitz (1893) Die Gattung Lophothalia, p. 218; Fkbg. (1901) p. 546; Cladostephus australis. C. Ag. (1824). Syst. p. 169; Polysiphonia cladostephus. Mont (1843) Ann. Sc. Nat. Lophothalia australis; R. L. 467. N.Z.
The Snares, Aucklands, Australia, Tasmania.

Bostrychia Montagne.

379. *Bostrychia arbuscula* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 226. R. L. 316. N.Z.
Endemic.

380. *Bostrychia caespitula* J. Ag. (1899) Anal. Algol. Cont. 4, p. 81. R. L. 314. N.Z.
Endemic.

381. *Bostrychia Harveyi* Mont. (1852) Fl. Chile, Tab. 16. 4. R. L. 315. N.Z. Our species is doubtfully identical with that of Southern America.
Australia, Chile, Patagonia.

382. *Bostrychia Laingii* J. Ag. (1899) Anal. Algol. Cont. 4, p. 69. R. L. 312. N.Z.
Endemic.

383. *Bostrychia mixta* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 27, and p. 539. R. L. 311. N.Z. Chathams.
Australia, South Africa.

384. *Bostrychia Novae Zelandiae* J. Ag. (1899) Anal. Algol. Cont. 4, p. 75. R. L. 313. N.Z.
Endemic.

385. *Bostrychia similis* Rbd. (1905) in Lg. T.N.Z.I., p. 384. R. L. 414. N.Z.
Endemic.

Sub-family RHODOMELEAE.

Trigenea Sonder.

Australasian Seas.

386. *Trigenea australis* Sond. (1845) Bot. Zeit. p. 54, No. 48. Rhodomela Trigenea Harv. Phyc. Austr. t. 126. Aucklands (Rabenhorst). Not recently identified.
Australia.

Rhodomela C. Ag.

Chiefly in Northern Atlantic Seas.

387. *Rhodomela Traversiana* J. Ag. (1877) Alg. N.Z. mar. p. 28. R. L. 320. N.Z. Chathams.
Endemic.

Sub-family POLYZONIEAE.

Dipterosiphonia Schmitz.

Throughout the Southern Seas.

388. *Dipterosiphonia heteroclada* (J. Ag.) Fkbg. (1901) p. 320. Polysiphonia heteroclada J. Ag. (1885) Bidr. Alg. Syst. 4, p. 98. R. L. 346. Polysiphonia dendritica; R. L. 321. N.Z. Chathams, Antipodes. N.Z. is the type locality. The true Polysiphonia (Dipterosiphonia) dendritica is a Brazilian plant, v. Fkbg. l.c.
Australia ? (I do not know whether the Dipterosiphonia dendritica of Lucas' List is this plant or not.)

Euzoniella Fkbg.

Chiefly in Australasian seas.

389. *Euzoniella adiantiformis* (Dcsne) Fkbg. (1901) p. 727. Polyzonia adiantiformis; R. L. 364. New Zealand. Stewart Is. (Lg.)
Endemic.

390. *Euzoniella bipartita* (Hook. f. et Harv.) Fkbg. (1901) p. 365. Polyzonia bipartita; R. L. 360. N.Z. Stewart Is. (Lg.)
Endemic.

391. *Euzoniella cuneifolia* (Mont.) Fkbg. (1901) p. 368. Polyzonia cuneifolia; R. L. 362. N.Z. The Snares, Aucklands, Campbell Is.
Endemic.

392. *Euzoniella flabellifera* (J. Ag.) Lg. (1909) Alg. Subant. Isl. of N.Z., p. 515. Polyzonia flabellifera; R. L. 363. The Snares, Campbell Is.
Endemic.

393. *Euzoniella incisa* (J. Ag.) Fkbg. (1901) p. 365, t. 5, fig. 2-8. Polyzonia incisa; R. L. 361. Dasyclonium acicarpum J. Ag.; R. L. 366. Kermadecs, N.Z. Chathams.
Australia, Tasmania.

394. *Euzoniella ovalifolia* (Hook. f. et Harv.) Fkbg. (1901) p. 367. Polyzonia ovalifolia; R. L. 365. N.Z. Chathams.
Endemic.

Sub-family HERPOSIPHONIEAE.

Streblocladia Schmitz.

N.Z. and (?) Mediterranean.

395. *Streblocladia neglecta* (Mont.) Schmitz. et Fkbg. (1897) in Engler und Prantl's Pflanzenf., p. 457. Polysiphonia botryocarpa (partim) (Hook. f. et Harv.) Fl. Antarct. 1, p. 69, t. 70. R. L. 336. N.Z., Aucklands.
Endemic.

Microcolax Schmitz.

Endemic genus.

396. *Microcolax botryocarpa* Schmitz et Fkbg. (1897) in Engler und Prantl's Pflanzenf., p. 458. Polysiphonia botryocarpa (partim.) R. L. 336. Parasitic on Streblocarpa neglecta. N.Z. Aucklands.
Endemic.

Herposiphonia Naegeli.

In most warmer seas.

397. *Herposiphonia ceratoclada* (Mont.) Fkbg. (1901) p. 313. Polysiphonia ceratoclada Mont. (1845) Voy. Pôle. Sud. 1, p. 130, t. 5, fig. 2. R. L. 323. N.Z. Chathams (Rbd.), Aucklands.
Australia, Chile, Amsterdam Id., St. Pauls Id.

398. *Herposiphonia Filipendula* (Harv.) Fkbg. (1901) p. 317. Polysiphonia Filipendula Harv. Austr. exsicc. no. 193. N.Z. The Bluff (Capra.)
Australia, S. & W.

399. *Herposiphonia pectinella* (Harv.) Fkbg. (1901) p. 317. Polysiphonia monilifera; R. L. 350. Polysiphonia versicolor. R. L. 353. Polysiphonia Sullivanae Fl. N.Z. 2, p. 232. N.Z.
Tasmania, Australia.

Lophosiphonia Fkbg.
In warmer seas.

400. *Lophosiphonia macra* (Hook. f. et Harv.) Fkbg. (1901) p. 503. Polysiphonia macra Fl. N.Z. 2, p. 227. Akaroa (Raoul), Hawkes Bay (Colenso.)
Endemic.

Sub-family AMANSIEAE.

Vidalia Lmx.
In warmer Atlantic, Mediterranean and Australasian seas.

401. *Vidalia Colensoi* (Hook. f. et Harv.) J. Ag. (1852) Sp. p. 1127. R. L. 358. N.Z.
Endemic.

Lenormandia Sonder.
Australasian seas.

402. *Lenormandia angustifolia* (Harv.) J. Ag. (1877) Alg. N.Z. mar. p. 30; De Toni et Forti (1923) p. 48. R. L. 356. N.Z.
Endemic (?)

403. *Lenormandia Chauvinii* Harv. (1852) in J. Ag. Sp. 2, p. 1104; J. Ag. (1877) Alg. N.Z. mar. no. 270. R. L. 355. N.Z. Chathams.
Australia.

Sub-family DASYEAE.

Dasya C. Ag.
In most warmer seas.

404. *Dasya collabens* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 535. R. L. 368. N.Z.
W. Australia, Japan.

Heterosiphonia Mont.
Widely distributed.

405. *Heterosiphonia Berkleyi* Mont. (1845) Voy. Pôle. sud. Bot. 1, p. 137, t. 5, fig. 1. Dasya Berkleyi J. Ag. Sp. 2, p. 1179. Aucklands.
Patagonia, Fuegia, Falklands, Kerguelen, Marion Is., South Georgia.

406. *Heterosiphonia concinna* (Hook. f. et Harv.) Fkbg. (1901) p 650. Dasya concinna; R. L. 372. N.Z. Chathams.
Endemic.

407. *Heterosiphonia firma* J. Ag. (1890) Bidr. Alg. Syst. 6, p. 73. R. L. 369. N.Z. Chathams.
? Falklands (not reported by Cotton.)

408. *Heterosiphonia punicea* (Mont.) Kylin (1919) Sub. Antarct. Meeresalgen 2, p. 65. Polysiphonia punicea Mont. Prodr. Phyc. Ant. 6. Aucklands.
Falklands.

409. *Heterosiphonia squarrosa* (Hook. f. et Harv.) De Toni. Dasya, squarrosa Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 232. R. L. 370. N.Z. Not to be confused with H. Berkleyi var. squarrosa Cotton. Crypt. Falk. Isl. p. 189.
Endemic.

410. *Heterosiphonia tessellata* (Hook. f. et Harv.) Fkbg. (1901) p. 645. R. L. 371. N.Z.
Endemic.

Pleurostichidium Heydrich.
Endemic genus (of uncertain position)

411. *Pleurostichidium Falkenbergii* Heydr. (1893) Berichte der Deutschen Gsellsch. t. 16; Fkbg. (1901) p. 480. N.Z. A curious species, parasitic on Xiphophora. N.Z.
Endemic.

Falkenbergia.
Australasian and Mediterranean Seas.

412. *Falkenbergia rufolanosa* (Harv.) Schmitz. Polysiphonia rufolanosa Harv. Mar. Bot. W. Austr. No. 87. On Sphacelaria (Halopteris paniculata. N.Z. (Grunow). The N.Z. habitat requires confirmation.
S. and W. Australia.

Family CERAMIACEAE.
Ptilothamnion Thuret.
Widely distributed.

413. *Ptilothamnion pectinatum* (Mont.) Lg. (1905) p. 388. N.Z. The Snares, Aucklands.
Endemic.

414. *Ptilothamnion Schmitzii* Heydr. (1893) Ber. d. Deutschen Bot. Gesellsch. 11, p. 75. R. L. 397. N.Z.
Endemic.

Griffithsia C. Ag.
In most warmer seas.

415. *Griffithsia antarctica* Hook. f. et Harv.) (1855) Fl. Antarct. 2, p. 488, Fig. 27-29; Skottsb. (1923) Rhodophyc. p. 56. R. L. 116. Bornetia (?) antarctica, de Toni, Syll. Alg. 4, p. 1297. N.Z. Chathams.
For description of fruiting specimens see Skottsb. above. It may turn out on examination of fertile specimens from N.Z. that the species here is not the same as the South American one.

Tasmania, Falklands, Kerguelen, Cape Horn.

G. gracilis Harv. (Chathams, Mueller) appears in various lists; but should be dropped. J. Ag. (T.N.Z.I. 6, p. 210) identified it thus: G. gracilis Harv., or an allied species in a sterile state.

Pandorea J. Ag.

Endemic genus.

416. *Pandorea Traversii* J. Ag. (1876) Epicr. p. 72. R. L. 117. N.Z. Chathams.
Endemic.

Monospora Solier.

Warmer European and Australasian Seas.

417. *Monospora griffithsioides* (Sonder.) De Toni (1903) 4, p. 1302. Griffithsia sonderiana J. Ag. (1876) Epicr. p. 62. R. L. 115. N.Z. Chathams.
Australia, Tasmania.

Pleonosporium Naegeli.

Atlantic, Mediterranean and Australasian Seas.

418. *Pleonosporium hirtum* (Hook. f. et Harv.) Lg., (1905) T.N.Z.I. p. 393. Callithamnion hirtum (partim R. L. 107). N.Z.
Endemic.

Callithamnion Lyngbye.

In all seas.

419. *Callithamnion Colensoi* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 259; Lg. (1905.) T.N.Z.I. p. 395. R. L. 108. N.Z.
Endemic.

420. *Callithamnion consanguineum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 295; Lg. (1905) T.N.Z.I., p. 395. R. L. 104. N.Z. (Akaroa, Lg.)
Endemic.

421. *Callithamnion cryptopterum* (Hook. f. et Harv.) Kuetz. Sp. (1849) p. 646. C. micropterum Hook. f. et Harv. (1847) (not of Mont.) Fl. Antarct. 1, p. 192. Aucklands. A little known and not recently collected species.

422. *Callithamnion gracile* Hook. f. et Harv. (1847) Fl. Antarct. Vol. 1, p. 191, t. 78, fig. 1. Campbell Is. A little known, and not recently collected species.
Endemic.

423. *Callithamnion puniceum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 259. R. L. 103. N.Z. Not recently collected.
Endemic.

Seirospora Harvey.

North Atlantic, Mediterranean, and Australasian seas.

424. *Seirospora byssoides* (Arnott) De Toni, (1903) Syll. Alg. 4, p. 1350. Callithamnion byssoides Arnott; Lg. T.N.Z.I. (1905), p. 394. var. *caulescens* J. Ag. (1876) Epicr. p. 29. Requires re-identification.
Europe.

Spongoclonium Sonder.
Australasian Seas.

425. *Spongoclonium Brounianum* (Hook. f. et Harv.) J. Ag. (1892) Anal. Algol. p. 39. Pleonosporium Brounianum (Hook. f. et Harv.) Harv. Gib. (1893) Journ. of Bot. p. 161; Lg. T.N.Z.I. (1905) p. 392. R. L. 112. N.Z. The generic position of this plant is scarcely satisfactorily determined.
Kermadecs, N.Z. S. and W. Australia.

426. *Spongoclonium brachygonum* (Hook. f. et Harv.) Lg. (1905) T.N.Z.I. p. 397. R. L. 106. N.Z.
Endemic.

427. *Spongoclonium pastorale* Lg. (1905) T.N.Z.I. p. 396. N.Z.
Endemic.

Warrenia Kuetzing.
Distribution as for species.

428. *Warrenia comosa* Harv. mscr. in Kuetz (1862) Tab. Phyc. vol. 12, t. 39. R. L. 111. Callithamnion comosum Harv. (1844) Lond. Journ. Bot. 3, p. 451. Antithamnion (?) confusum Lg. R. L. 110 and T.N.Z.I. (1905) p. 406. J. Ag. Epicr. p. 25 wrongly as I believe identifies Callithamnion (?) confusum J. Ag. with Wrangelia squarrulosa. N.Z.
Australia, Tasmania.

Plumariopsis De Toni
N.Z. and South Georgia.

429. *Plumariopsis pellucida* (Hook. f. et Harv.) De Toni Syll. 4, p. 1355. Euptilota pellucida (Hook. f. et Harv.) Lg. (1905) T.N.Z.I. p. 399. Ptilota pellucida; R. L. 118. N.Z.
Endemic.

Euptilota Kuetz.
Chiefly in Australasian seas.

430. *Euptilota formosissima* (Mont.) Kuetz. (1849) Sp. p. 671. Ptilota formosissima; R. L. 119. N.Z. The Snares, Chathams, Aucklands.
Endemic.

Ballia Harvey.
Distribution as for the species.

431. *Ballia callitricha* (C. Ag.) Mont. (1844) in Dict. Univ., p. 442, t. 2. N.Z., Chathams, Aucklands.
I am not sure that Harvey's name B. Brunonis (Hook. Lond. Journ. Bot. (1843) 2, p. 191, t. 9) should not stand, but have not the necessary literature to determine priority.
South Circumpolar Ocean, and Australia.

432. *Ballia scoparia* Hook. f. et Harv. (1845) Lond. Journ. Bot. 4, p. 173, Alg. Austr. Exsicc. no. 502; R. L. 114. N.Z. Chathams. Harvey originally placed this in the genus Callithamnion, but aferwards removed it to Ballia.
Australia, Tasmania, South America.

Antithamnion Naegeli.

433. *Antithamnion adnatum* J. Ag. (1892) Anal. Algol. p. 21; Lg. (1905) T.N.Z.I., p. 402. R. L. 99. N.Z.
Endemic.

434. *Antithamnion applicitum* (Hook. f. et Harv.) J. Ag. (1892) Anal. Algol. p. 21; Lg. (1905) T.N.Z.I., p. 402; R. L. 100. N.Z.
Japan (Yendo.)

435. *Antithamnion flaccidum* (Hook. f. et Harv.) De Toni (1903) Syll. Alg. 4, p. 1414; Lg. (1905) T.N.Z.I. p. 405. Callithamnion flaccidum; R. L. 102. N.Z. Cotton (Crypt. Falk. Isl. p. 191) considers the N.Z. plant likely to be distinct from that of the Falklands.
Fuegia, Tasmania, Falklands.

436. *Antithamnion mucronatum* (J. Ag.) Naeg. (1861) Ceramiac. p. 146; Lg. (1905) T.N.Z.I. p. 404. N.Z.
Australia, Tasmania.

437. *Antithamnion plumula* (Ellis) Thuret (1863) in Le Jolis Liste des Alg. de Cherb; Lg. (1905) T.N.Z.I. p. 405. N.Z. var. *investiens* J. Ag. (1876) Epicr. p. 24.
Atlantic, Mediterranean, Australia, Fuegia.

438. *Antithamnion Ptilota* (Hook. f. et Harv.) Harv. Gib. (1893) Journ. of Bot. p. 161. R. L. 98. N.Z. Seacliff (Lg.). If correctly identified at N.Z. and Crozets, doubtless to be found at intermediate points.
Crozets.

Antithamnionella Lyle.

Widely distributed.

439. *Antithamnionella ternifolia* (Hook. f. et Harv.) Lyle (1922) Journ. of Bot. vol. 60, p. 350. Antithamnion ternifolium. Lg. (1905) T.N.Z.I. p. 407. R. L. 396. N.Z.
Fuegia.

Spyridia Harvey.

In most warmer Seas.

440. *Spyridia opposita* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 256. R. L. 197. N.Z.
Australia.

441. *Spyridia biannulata* J. Ag. (1876) Epicr. p. 267. R. L. 198. N.Z.
Australia, Tasmania.

Ceramium (Roth) Lyngbye.

In all Seas.

442. *Ceramium apiculatum* J. Ag. (1876) Epicr. p. 105. R. L. 127. Ceramium cancellatum (partim) Hook. f. et. Harv. Fl. N.Z. 2, p. 256. N.Z. Aucklands.
Endemic.

443. *Ceramium Aucklandicum* Kuetz. (1849) Sp. p. 686. J. Ag. (1894) Anal. Algol. Cont. 2, p. 36. N.Z. (The Bluff, Capra) Aucklands.
Endemic.

444. *Ceramium clavulatum* C. Ag. in Syn. Fl. Aeq. vol. 1, p. 2; Schmitz, (1897) in Engler und Prantl's Pflanzenf, p. 501. Centroceras clavulatum. R. L. 135. N.Z. Chathams.
Widely distributed.

445. *Ceramium diaphanum* (Lightf.) Roth. (1806) Catalecta Botanica 3, p. 154. R. L. 121. N.Z., Aucklands.
Almost cosmopolitan.

446. *Ceramium discorticatum* Heydr. (1893) Ber. der Deutch Bot. Gesellsch. vol. 11, p. 77. R. L. 399. N.Z.
Endemic.

447. *Ceramium divergens* J. Ag. (1894) Anal. Algol. Cont. 2, p. 27. R. L. 129. N.Z.
Tasmania.

448. *Ceramium gracillimum* (Kuetz ?) Harv. (1876) in J. Ag. Epicr. p. 95. R. L. 131. N.Z. Doubtfully identical with the European form.
Tasmania, Europe, U.S.A.

449. *Ceramium Laingii* Rbd. (1905) in Lg. T.N.Z.I., p. 382. R. L. 400. N.Z.
Endemic.

450. *Ceramium miniatum* (?) Suhr. (1851) J. Ag. Sp. 2, p. 135; Harv. Phyc. Austr. t. 206A. R. L. 132. A doubtful inhabitant of N.Z.
Australia.

451. *Ceramium nobile* J. Ag. (1894) Anal. Algol. Cont. 2, p. 41. R. L. 130. N.Z.
West Australia, Tasmania (De Toni et Forti.)

452. *Ceramium nodiferum* J. Ag. (1876) Epicr. p. 99. R. L. 122. N.Z. Chathams (von Mueller.)
S. Australia.

453. *?Ceramium pusillum* Harv. (1863) Phyc. Austr. Syn. No. 619; J. Ag. Anal. Algol. Cont. 2, p. 21. R. L. 125. A doubtfully identified species. N.Z.
Australia.

454. *Ceramium rubrum* (Huds.) C. Ag. (1817) Syn. p. 60 (partim.) R. L. 128. N.Z. Aucklands, Campbell Is. This species has in part been replaced for N.Z. by Ceramium nobile, and it is not yet clear whether C. rubrum *forma typica* is to be found on the coast of N.Z.
Almost cosmopolitan.

455. *Ceramium stichidiosum* J. Ag. (1876) Epicr. p. 105. R. L. 123. Chathams.
var. *Smithii.* Lg. (1909) p. 522. Aucklands.
var. *scopulorum* Lg. (1909) p. 523. The Snares.
Tasmania. (The varieties perhaps endemic.)

456. *Ceramium vestitum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 256. R. L. 124. N.Z. Antipodes. A species of somewhat doubtful distinctness.
Endemic.

457. *Ceramium uncinatum* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 257. R. L. 126. N.Z. A very distinct little species.
Endemic.

Microcladia Greville.
Widely distributed.

458. *Microcladia Novae Zealandiae* J. Ag. (1877) Anal. Algol. Cont. 4, p. 35. N.Z.
Endemic.

459. *Microcladia pinnata* J. Ag. (1897) Anal. Algol. cont. 4, p. 34. R. L. 133. N.Z. Aucklands.
Endemic.

Rhodocorton Naegeli.

460. *Rhodocorton Rothii* (Turton) Naegeli (1861) Beit. zur. Morph. der Ceramiac., p. 121. R. L. 97. N.Z. All temperate and colder seas, not yet recorded from Australia.

461. *Rhodocorton subsalsum* Lemm (1907) p. 379. Chathams.
Endemic.

Family GRATELOUPIACEAE.
Aeodes J. Ag.
Widely distributed.

462. *Aeodes nitidissima* J. Ag. (1876) Epicr. p. 680. N.Z. R. L. 144.
N.W. America (Setchell.)

Grateloupia C. Ag.
In most warmer seas.

463. *Grateloupia filicina* (Wulf.) J. Ag. (1851) Sp. 2, p. 180. R. L. 148. N.Z. Chathams.
Mediterranean, Australia, Atlantic, Cape of Good Hope, Indian Ocean.

464. ??*Grateloupia caudata* J. Ag. (Sp. Nov.). Appears as a *nomen nudum* T.N.Z.I., vol. 6, p. 209. So far as I know this has not been described. At any rate the name is preoccupied, there being a G. caudata Kuetz. (Tab. Phyc. 17, t. 23, Fig. d.) from Martinique.

465. *Grateloupia pinnata* (Hook. f. et Harv.) J. Ag. (1876) Epicr. p. 151. R. L. 147. Nemastoma pinnata Hook. f. et Harv. N.Z. var. *endiviaefolia* (Hook. f. et Harv.) J. Ag. l.c. var. *Daviesii* (Hook. f. et Harv.?) J. Ag. l.c., p. 152.
Endemic.

466. *Grateloupia prolifera* J. Ag. (1876) Epicr. p. 150. R. L. 145. N.Z. Chathams.
Tasmania.

467. *Grateloupia stipitata* J. Ag. (1876) Epicr. p. 151. R. L. 146 N.Z.

Pachymenia J. Ag.
In Southern Seas.

468. *Pachymenia dichotoma* J. Ag. (1876) Epicr. p. 146. R. L. 141. N.Z.
Endemic.

469. *Pachymenia himantophora* J. Ag. (1876) Epicr. p. 680. R. L. 142. N.Z.
Endemic.

470. *Pachymenia laciniata* J. Ag. (1876) Epicr. p. 145. R. L. 143. N.Z.
Endemic.

471. *Pachymenia lusoria* (Hook. f. et Harv.) J. Ag. (1876) Epicr. p. 146. R. L. 140. Iridaea lusoria Hook f. et Harv. (1855) Fl. N.Z. 2, p. 252. N.Z., The Snares, Antipodes.
Endemic.

Prionitis J. Ag.
Californian and Australasian Seas.

472. *Prionitis (?) Colensoi* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 254, t. 120A. Thysanocladia Colensoi. R.L. 199. N.Z. The generic position of this plant is uncertain.
Endemic (? Japan, Yendo.)

Cryptonemia J. Ag.
In the warmer seas.

473. *Cryptonemia latissima* J. Ag. (1876) Epicr. p. 682. R. L. 149. N.Z.
Endemic.

Thamnoclonium Kuetz.
In Australasian Seas.

474. *Thamnoclonium claviferum* J. Ag. (1876) Epicr. p. 168. R. L. 401. N.Z.
Australia, Tasmania.

Family NEMASTOMACEAE.
Schizymenia J. Ag.
Widely distributed.

475. *Schizymenia Novae Zelandiae* J. Ag. (1876) Epicr. p. 677. N.Z.
Endemic.

476. *Schizymenia stipitata* J. Ag. (1876) Epicr. p. 121. R. L. 136. N.Z. Yendo (Notes 6, p. 94) suggests that this may only be a state or form of Schizymenia laciniata.
Endemic.

Nemastoma J. Ag.
Widely distributed.

477. *Nemastoma intestinalis* Hook. f. et Harv. (1855) Fl. N.Z. 2, p. 255. R. L. 137. N.Z. Chathams.
Endemic.

478. *Nemastoma laciniata* J. Ag. (1876) Epicr. p. 128. Anal. Algol. Cont. 5, p. 76. R. L. 139. N.Z.
Japan.

Family SQUAMARIACEAE.

Peyssonnelia Decaisne.
In most warmer seas.

479. *Peyssonnelia rubra* (Grev.) J. Ag. (1851) Sp. 1, p. 502. Kermadecs (Oliver.)
Adriatic, Polynesia.

Family CORALLINACEAE.

Melobesia Lmx.
In most warmer seas.

480. *Melobesia amplexifrons* Harv. (1847) Ner. Austr. p. 110. R. L. 382. This should perhaps be Lithophyllum amplexifrons (Harv.) Heydr. N.Z. Chathams.
South Africa.

481. *Melobesia (Heteroderma) Caulerpae* Fosl. (1906) Algol. Not. 2, p. 16. On Caulerpa sedoides, Island Bay, Wellington.
Endemic.

482. *Melobesia (Pliostroma) explanata* Fosl. (1908) Algol. Not. 2, p. 6. Island Bay, Wellington.
Endemic.

483. *Melobesia leptura* Fosl. (1906) Algol. Not. 2, p. 16. On Stenogramma, Pterocladia, and Lenormandia. Island Bay, Wellington.
Endemic.

484. *Melobesia Novae Zelandiae* (Heydr.) De Toni. Syll. Alg. 4, p. 1767. On Bryozoa filiformis. N.Z. (Heydrich.)
Endemic.

Choreonema Schmitz.
Distribution as for species.

485. *Choreonema Thureti* (Born) Schmitz (1889) Syst. ueber. der Gatt. Florid., p. 21, De Toni et Forti (1923) p. 59. Lyalls Bay (Filhol.)
Atlantic, Mediterranean, Australia.

Lithophyllum Phillipi.
In most warm and temperate seas.

486. *Lithophyllum decussatum* (Ell. et Sol.) Fosl. (1909.) Algol. Not. 2, p. 22. Lithothamnion agariciforme; R. L. 385. Melobesia agariciformis Aresch. (1852) in J. Ag. Sp. 2, p. 516. (partim.) Chathams, Grahams Land. The synonymy is complicated, and the exact position of the N.Z. form is yet to be determined.
In one variety or another widely distributed.

487. *Lithophyllum detrusum* Fosl. (1906) Algol. Not. 2, p. 21. Island Bay, Wellington.
Endemic.

488. *Lithophyllum (Dermatolithon) Carpophylli* (Heydr.) Fosl. (1909) Algol. Not. 4, p. 51. R. L. 386. Melobesia Carpophylli Heydr. (1893) Ber. der Deutsch. Bot. Geselsch. 11, p. 78. Bay of Islands, Chathams.
Endemic.

489. *Lithophyllum (Carpolithon) jugatum* Fosl. (1906) Algol. Not. 2, p. 26. Island Bay, (Wellington).
Endemic.

490. *Lithophyllum tuberculatum* Fosl. (1906) Algol. Not. 2, p. 21. Island Bay, Wellington.
Endemic.

Lithothamnion Phillipi.

In most warm and temperate seas.

491. *Lithothamnion asperulum* Fosl. (1907) Algol. Not. 4, p. 6. N.Z. Wellington (Setchell).
Endemic.

492. *Lithothamnion Aucklandicum* Fosl. (1907) Algol. Not. 4, p. 18. Auckland Islands (Brit. Antarct. Exped. "Discovery").
Endemic.

493. *Lithothamnion calcareum* (Ell. et Sol.) Aresch (1851) in J. Ag. Sp. 2, p. 523. R. L. 384. N.Z.
Widely distributed.

494. *Lithothamnion Chathamense* Fosl. (1906) Algol. Not. 2, p. 6. Chathams.
Endemic.

495. *Lithothamnion cystocarpideum* Fosl. (1906) Algol. Not. 2, p. 7. Chathams.
Endemic.

496. *Lithothamnion Geppii* Lemoine (1917) Melobesieae "Terra Nova" Exped. p. 23. N.Z. (Spirits Bay).
Endemic.

497. *Lithothamnion haptericolum* Fosl. (1906) Algol. Not. 2, p. 8. Island Bay (Wellington). On Ecklonia.
Endemic.

498. *Lithothamnion incisum* Fosl. (1909) Algol. Not. 4, p. 12. N.Z. Chathams.
Endemic.

499. *Lithothamnion insigne* Fosl. (1906) Algol. Not. 2, p. 9. Island Bay (Wellington).
Endemic.

500. *Lithothamnion patena* (Harv.) Heydr. (1901) Lith. Mus. Paris p. 542. Melobesia Patena Harv. (1847) Nereis. Austr. p. 111, t. 40. R. L. 381. Foslie at first considered this a variety of L. lichenoides (Ellis) Heydr. but later constituted it a separate species.
N.Z. Chathams, Aucklands, Australia, Tasmania, Cape of Good Hope, Falklands.

Amphiroa Lmx.

Widely distributed in warmer seas.

501. *Amphiroa elegans* Harv. (1847) Ner. Austr. 99, t. 38. R. L. 375. N.Z.
Australia, S. Africa.

Cheilosporum (Dcsne) Areschoug.

502. *Cheilosporum elegans* (Hook. f. et Harv.) Aresch. (1852) in J. Ag. Sp. 2, p. 546. Arthrocardia corymbosa; R. L. 373. Amphiroa elegans Hook. f. et Harv. Kermadecs, N.Z. Chathams.
E. Australia, S. Africa.

503. *Cheilosporum Wardii* (Harv.) De Toni (1905) Syll. Alg. Vol. 4, p. 1828. Arthrocardia Wardii; R. L. 374. Amphiroa Wardii Ner. Austr. p. 99, tab. 38. N.Z. Chathams.
Australia.

Corallina (Tournefort) Lmx.

In all warm and temperate seas.

504. *Corallina armata* Harv. (1849) Ner. Austr. p. 103, t. 40, fig. 1-7. R. L. 375A. N.Z. Chathams.
Endemic.

505. *Corallina Cuvieri* Lmx. (1816) Poly. Flex. p. 286. Jania Cuvieri Dcsne. R. L. 378. Kermadecs, N.Z. Chathams. A variable species no doubt appearing under other names.
S. Australia, Tasmania, and widely in the Pacific.

506. *Corallina granifera* Ell. et Sol. (1786) Zoophyt. p. 120. var. *australis* (Grun.) De Toni (1905) Syll. Alg. 4, p. 1845. N.Z. Antipodes. Perhaps only a form of the polymorphic C. Cuvieri. (v. De Toni et Forti 1923, p. 63.)
Australia, Africa, Mediterranean.

507. *Corallina Hombronii* (Mont.) Aresch. (1852) in J. Ag. Sp. 2, p. 574. Jania, Hombronii Mont. Aucklands.
Endemic.

508. *Corallina (Jania) pistillaris* Mont. (1845) Voy. Pôle Sud. Bot. 1, p. 147. N.Z. Requires further investigation.
Endemic.

509. *Corallina pilulifera* Post et Rupr. (1840) Illustr. p. 20, t. 40, fig. 101. N.Z. (Cotton). Cotton gives this as a N.Z. species. (Crypt. Falk. Isl. p. 192), but I do not know for what reason.
Pacific Coasts, Japan, Fuegia, Falklands.

510. *Corallina pedunculata* Lmx. (1816) Polyp. Flex. p. 271, t. 9. Chathams. I know nothing of this species.
Australia.

511. *Corallina officinalis* L.; De Toni Syll. 4, p. 1834. R. L. 377. Kermadecs, N.Z.
Widely distributed.

512. *Corallina (Jania) micrarthrodia* Lmx. (1816) Polyp. Flex. p. 216, t. 9, fig. 5, a.b. R. L. 380. N.Z. Chathams.
Australia, Tasmania.

LITERATURE CONSULTED.

(The square brackets indicate the abbreviation used in citation.)

AGARDH, C. A., 1824. Systema Algarum, [C. Ag. Syst.]
—— 1839 Revision der Algengattung Macrocystis (Acta. Acad. Caes. Leopold. Vol. 19, pp. 283-316.)
AGARDH, J. G., 1848. Species, genera et ordines Algarum, volumen primum: Algas Fucoideas complectens. [J. Ag. Sp.] Volumen Secundum: Algas Florideas complectens.
—— 1851. Voluminis secundi, pars prior. [J. Ag. Sp. 2.]
—— 1852. Voluminis secundi, pars secunda. [J. Ag. Sp. 2.]
—— 1863. Voluminis secundi, pars tertia. [J. Ag. Sp. 2.]
—— 1876. Voluminis tertii; Epicrisis Systematis Floridearum. [Epicr.]
—— 1880. Volumen tertium, pars secunda. [J. Ag. Sp. 3, p. 2.]
—— 1898. Volumen Tertium, pars tertia: De dispositione Delesseriarum, curae posteriores. [J. Ag. Sp. 3, p. 3.]
—— 1901. Voluminis tertii, pars quarta. [J. Ag. Sp. 3, p. 4.]
—— 1870. Om Chatham-oarnes Alger (Oefvers K. Vet, Akad. Förhandl. Stockholm, pp. 435-455. [J. Ag. Alg. Chath.]
—— 1874. List of the Algae of the Chatham Islands, collected by H. H. Travers, Esq. (T.N.Z.I. 6, p. 208-210.)
—— 1877. De Algis Novae Zelandiae Marinis. (Lunds Univers. Aarsskrift. T. 14.) [Alg. N.Z. Mar.]
—— 1879. Florideernes Morphologi, (K. Svenska Vet, Akad. Handl.) Band. 15. n. 6. Stockholm.
—— 1872. Till Algernes Systematik, Nya Bidrag. I. Caulerpa; 2. Zonaria; 3 Sargassum. (Lunds Univers. Aarsskrift T. 9.) [Bidr. Alg. Syst. 1.]
—— 1880. Till Algernes Systematik, Nya Bidrag. 4 Chordarieae; 5 Dictyotaceae. (Lunds. Univers. Aarsskrift. T. 17.) [Bidr. Alg. Syst. 2.]
—— 1882. Till Algernes Systematik, Nya Bidrag. 6 Ulvaceae. (Lunds. Univers. Aarsskrift. T. 19.) [Bidr. Alg. Syst. 3.]
—— 1885. Till Algernes Systematik, Nya Bidrag. 7 Florideae. (Lunds. Univers. Aarsskrift. T. 22.) [Bidr. Alg. Syst. 4.]
—— 1886. Till Algernes Systematik, Nya Bidr. 8 Siphoneae. (Lunds. Univers. Aarsskrift. T. 23.) [Bidr. Alg. Syst. 5.]
—— 1890. Till Algernes Systematik, Nya Bidrag 9 Sporochnoideae. (Lunds. Univers. Aarsskrift. T. 26.) [Bidr. Alg. Syst. 6.]
—— 1889. Species Sargassorum Australiae descriptae et dispositae. (K. Svenska Vet, Akad. Handl. B. 23 No. 3) Stockholm.
—— 1892. Analecta Algologica (Lunds. Univers. Aarsskrift. T. 28.) [Anal. Algol.]
—— 1894. Analecta Algologica. Continuatio 1 (L.U.A.T. 29.) [Anal. Algol. Cont. 1.]
—— 1894. Analecta Algologica. Continuatio 2 (L.U.A.T. 30.) [Anal. Algol. Cont. 2.]
—— 1896. Analecta Algologica. Continuatio 3 (Acta Reg. Soc. Physiogr. Lund. T. 7.) [Anal. Algol. Cont. 3.]
—— 1897. Analecta Algologica. Continuatio 4 (A. R. S. P. Lund. T. 8.) [Anal. Algol. Cont. 4.]
—— 1899. Analecta Algologica. Continuatio 5 (A. R. S. P. Lund. T. 10.) [Anal. Algol. Cont. 5.]

BARTON, E. S., 1893. Xiphophora Billardieri Mont. (Phycological Memoirs. By G. Murray. Part 6, pp. 7-8.)
—— 1899. On Notheia anomala, Harv. et Bail. (Journ. Linn. Soc. Bot. Vol. 34, pp. 417-425.)
BORGESEN, F., 1924. Marine Algae from Easter Island in Skottsberg, Natural history of Juan Fernandez and Easter Island.
BORNET, E. ET FLAHAULT, Ch., 1889. Sur quelques plantes vivant dans le teste calcaire des Mollusques. (Bulletin de la Sociète botanique de France, tome. 36.)
—— 1888. Sur deux nouveaux genres d'algues perforantes. (Journal de Botanique, Mai pp. 1-5.)
COTTON, A. D., 1907. Marine Algae from the Chatham Islands. (R. Bot. Gardens, Kew, Bull of misc. inform. No. 2, pp. 37-43.)
—— 1908. The New Zealand species of Rhodophyllis (Kew, Bull of Misc. Inform. No. 3.)
—— 1909. Notes on New Zealand Marine Algae. (Kew, Bull of Misc. inform. No. 6, pp. 239-243.)
—— 1915. Cryptogams from the Falkland Islands, (Linn. Soc. Journ. Botany Vol. 43, pp. 137-231.)
—— 1912. Marine Algae, Clare Island Survey, Part 15. (Proceedings of the Royal Irish Acad. Vol. 31.)
DE TONI, G. B., 1907. Sylloge Algarum onnium hucusque cognitarum. Vol. 5 Myxophyceae.
—— 1924. Sylloge Algarum. Vol. 6. Florideae Section 5, additamenta.
DE TONI, G. B. e Achille Forti, 1920. Contributo alla conoscensca della flora marina del Chili.
—— 1923. Alghe di Australia, Tasmania e Nuova Zelanda. [De Toni et Forti, 1923.]
DICKIE, G., 1879. Algae collected in Kerguelen's Land during the Transit of Venus Expedition. (Phil. Trans. Roy. Soc. 168, pp. 53-64.)
FALKENBERG, P., 1901. Die Rhodomelaceen. (Fauna und Flora des Golfes von Neapel T. 26. [Falkenberg, 1901.]
FOSLIE, M., 1906. Algologiske Notiser 2. (K. Norske, Vidensk. Skrift 2.)
—— 1907. Algologiske Notiser 4. (K. Norske, Vidensk. Skrift 6.)
—— 1908. Pliostroma (K. Norske, Vidensk. Skrift 11.)
—— 1909. Algologiske Notiser 6. (Ibidem.)
GAIN, L., La flore algologique des regions antarctiques et subantarctiques. (Deuxieme Expedition antarctique francaise, (1908-1910) Paris, Masson et Cie.)
GEPP, A. and E. S., 1906. Some marine Algae from New South Wales. (Journal of Bot., pp. 249-261.)
—— 1911. Marine Algae from the Kermadecs. (Journ. of Botany, 1911, Jan., pp. 17-23.)
—— 1917. Marine Algae (British Antarctic "Terra Nova" Expedition, 1910, Nat. Hist. Reports, Botany, Part 2, pp. 17-22, London.)
GIBSON, HARVEY R. J., 1893. On some marine Algae from New Zealand. (Journ. of Bot. Vol. 31, pp. 161-167.)
GOOR, A. J. C. VAN, 1923. Die Hollaendischen Meeres-Algen. (Tweedie Sectie), Amsterdam.
GRUNOW, A., 1867. Algen, m. 12 Taf. (Reise S. M. F. Fregatte Novara um die erde, Botan. Theil, Bd. 1 Wien.)
HARVEY, W. H., 1847-49. Nereis Australis or Algae of the Southern Ocean, deposited in the Herbarium of the Dublin University. Parts 1 and 2, London. [Ner. Austr.] It is almost impossible to obtain these volumes; and they are always sold at a very high price. My copy is very imperfect.
—— 1858-63. Phycologia Australica, or a history of Australian Seaweeds. Vol. 1-5 (with Synopsis and Indexes.) London. [Phyc. Austr.] The Synopsis is referred to as [Syn.]
HEYDRICH, F., 1893. Vier neue Florideen von Neu Seeland (Bericht. der Deutschen botan. Gesellsch. Band 11, pp. 75-79.)
HOOKER, J. D., 1844-47. Flora Antarctica, Vols. 1-2, London. The Seaweeds are by W. H. Harvey. [Hook. f. et Harv. Fl. Ant.]
—— 1853-1855. Flora Novae Zelandiae, Vols. 1-2. The Seaweeds are by W. H. Harvey. [Hook. f. et Harv. Fl. N.Z.]

—— 1860. Flora Tasmaniae. The Seaweeds are by W. H. Harvey. [Hook. f. et Harv. Fl. Tasm.]
—— 1867. Handbook of the New Zealand Flora. The Seaweeds are by W. H. Harvey. [Hook. f. et Harv. Handb. N.Z. Fl.] This is still the most useful compendium of descriptions of species for the N.Z. Student.
KIRK, T., 1879. Description of a new species of Cladophora, T.N.Z.I. Vol. 12, p. 397.
KUETZING, F. T., 1849. Species Algarum. [Kuetz. Sp.]
KYLIN and SKOTTSBERG, 1919. Zur Kentniss der subantarktischen und Antarkischen Meeresalgen. 2. Rhodophyceen (Die Schwedischen Sud-polar Expedition 1901-03. Band 4, Lief, 15.)
LAING, R. M., 1885. Observations on the Fucoideae of Banks Peninsula. (T.N.Z.I. Vol. 17, pp. 303-311.)
—— 1892. Notes on Splachnidium rugosum, Grev. (T.N.Z.I. Vol. 25, pp. 288-289.)
—— 1893. On Lessonia variegata J. Ag. mscr. (T.N.Z.I. Vol. 26, pp. 304-310.)
—— 1895. The Algae of New Zealand; their characteristics and distribution. (T.N.Z.I. Vol. 27, pp. 297-318.)
—— 1896. Notes on several species of Delesseria, one being new. (T.N.Z.I. Vol. 29, pp. 446-450.)
—— 1899. Revised list of New Zealand Seaweeds. Part 1. (T.N.Z.I. Vol. 32, pp. 57-70.) [R. L.]
—— 1900. A list of Seaweeds of Norfolk Island. (T.N.Z.I. Vol. 32, pp. 299-301.)
—— 1901. Revised List of New Zealand Seaweeds. Part 2. (T.N.Z.I. Vol. 34, pp. 327-359.) [R. L.]
—— 1904. On the New Zealand Species of Ceramiaceae. (T.N.Z.I. Vol. 37, pp. 384-408.)
—— 1905. Appendix to the List of Seaweeds of Norfolk Island. (T.N.Z.I. Vol. 38, pp. 424.)
—— 1905. Revised List of New Zealand Seaweeds, Appendix 1. (T.N.Z.I. Vol. 37, pp. 381-384.) [R. L.]
—— 1906. Note on the occurence of Phyllitis fascia (Muell.) Kuetz. in New Zealand. (T.N.Z.I. Vol. 39, pp. 220-221.)
—— 1909. The Marine Algae of the Sub-antarctic Islands of New Zealand in Chilton, the Sub-antarctic. Island N.Z. Vol. 2, pp. 503-527.
—— 1909. Scientific Results of the N.Z. Government trawling Expedition, Algae. (Records Canterbury Mus. (N.Z.) 2, pp. 65-70.)
LEMMERMANN, E., 1907. Die Algenflora der Chatham Islands (Jahrbucher fur syst. Botanik, 38, pp. 343-382.)
LESSON, A. ET RICHARD A., 1932. Voyage de L'Astrolabe, (1826-1829) Botanique. (The Seaweeds are described by A. Richard.)
LUCAS, A. H. S., 1909. Revised List of the Fucoideae and Florideae of Australia. (Proceed. Linn. Soc. of N. S. Wales. Vol. 34, pp. 1-60.)
—— 1912. Supplementary List of the Marine Algae of Australia. (Proceed. Linn. Soc. of N. S. Wales. Vol. 37, pp. 151-171.)
—— 1913. Notes on Australian Marine Algae. (Proceed. Linn. Soc. of N. S. Wales. Vol. 38, pp. 49-60.)
—— 1916. An efflorescence on some New Zealand Kelps. (Proceed. Linn. Soc. N. S. W. Vol. 41, pp. 676-679.)
—— 1919. Notes on Australian Marine Algae 2. (Proceed. Linn. Soc. N.S. Wales, vol. 44, pp. 174-179.)
—— 1919. The Algae of Commonwealth Bay. (Australasian Antarctic Exped. 1911-14.)
MAZZA, A., 1905-1925. Saggio de Algologia Oceanica. (La Nuova Notarisia Ser. 16. et seq.)
MITCHELL, M. O. and WHITING, F. G., 1892. On Splachnidium rugosum, Grev. The type of new order of Algae. (Phycological Memoirs edit. G. Murray part 1, pp. 1-10.)
MITCHELL, M. O., 1893. Notheia anomala. Bail. et Harv. (Phycological Memoirs edit. G. Murray P. 2, pp. 36-37.)
MOLLETT, T. A., 1880. On the Structure of Hormosira Billardieri. (T.N.Z.I. Vol. 13, pp. 318-323.)

MONTAGUE, C., 1827-1840. Plants Cellulaires du Voyage au Pôle Sud sur les Corvettes l'Astrolabe et la Zélée, sous le commandement de M. J. Dumont D'Urville.
MURRAY, G., 1893. On the Cryptosomata of Adenocystis, Alaria, and Saccorhiza. (Phycological Memoirs P. 2, pp. 61-64.)
NAEGELI, C., 1861. Beitrag zur Morphologie und Systematik der Ceramiaceae. (Aus dem Sitzundsberichten der k. b. Akademie der Wissensch. in Muenchen.)
OLIVER, W. R. B., 1923. Marine Littoral Plant and Animal Communities in New Zealand. (T.N.Z.I. Vol. 54, pp. 496-545.)
RABENHORST, L., 1878. Beitrag zur Meeresalgenflora von Aucklandinseln. (Hedwigia 17. No. 5, pp. 65-79.)
REINBOLD, TH., 1899. Ergebnisse einer Reise nach dem Pacific. (Prof. Dr. Schauinsland 1896-97.) Meeresalgen (Abhandl. Nat. Ver. Bremen 16, pp. 287-302.)
—— 1900. Meeresalgen von den Norfolk Inseln. (La Nuova Notarisia ser. 11, pp. 147-153.)
—— (? date). Die Meeresalgen der deutschen Tiefsee Expedition. (1898-1899.)
—— (? date). Die Meeresalgen der deutschen Sud polar expedition. (1901-1903.)
REINKE, J., 1890. Uebersicht der Bisher bekannten Sphacelariaceen. (Ber. der deutschen botan. Gesellsch. 8, pp. 201-215.)
SAUVAGEAU C., 1902. Sur les Sphacelariac. d'Australasie. (Notes from the Botan. School of Trinity Coll., Dublin No. 5, pp. 196-200.)
—— 1900. Remarques sur les Sphacelariacees, (Journ. de Botanique, vol. 14, pp. 1-51, pp. 247-259, pp. 304-312, pp. 313-322.
—— 1901. Vol. 15, pp. 22-36, pp. 50-62, pp. 105-116, pp. 137-149.
—— 1903. Vol. 17, pp. 69-95.
SETCHELL, W. A., 1914. The Scinaia Assemblage. (Univers. of California Public. Botany. Vol 6, pp. 79-152.)
—— 1914. Parasitic Florideae 1. (Univers. of California Public. Botany. Vol. 6, pp. 1-34.)
SETCHELL, W. A. and GARDINER, N. L. The Marine Algae of the Pacific coast of North America. Part 2, Chlorophyceae. (Univers. of California, Public Botany.)
SKOTTSBERG, C., 1907. Zur Kenntniss der subantarktischen und antarktischen Meeresalgen 1. Phaeophyceen (Wissensch. Ergebn. der Schwed. Sud polar-Exped. 1901-1903. Band 4, Lief. 6.
—— 1921. Botanische Ergebnisse der Schwed. Expedition nach Patagonien. Marine Algae 1. Phaeophyceae.
—— 1923. Marine Algae 2. Rhodophyceae.
SONDER, W., 1871. Die Algen von Tropischen Australiens (Abhandl. des Naturwissensch. Ver. zu Hamburg. Band 5, pp. 35-74.
TURNER, D., 1808-1819. Fuci, sive plantarum Fucorum generi a botanicis adscriptarum icones, descriptiones et historia.
WEBER, VAN BOSSE, A., 1898. Monographie des Caulerpes. (Ann. Jard. botan. de Buitenzorg. Vol. 16, pp. 243-401.)
—— 1913. Liste des Algues du Siboga 1. Myxophyceae, Chlorophyceae, Phaeophyceae.
—— 1921. 11. Liste des Algues du Siboga. (Rhodophyceae.)
YENDO, K., 1909-1918. Notes on Algae new to Japan. (From the Botanical Magazine, Tokyo, vol. 28.)

Fourth Supplement to the Uredinales and Ustilaginales of New Zealand.

By G. H. CUNNINGHAM, Government Mycologist, Wellington.

[*Read before the Wellington Philosophical Society, 4th October, 1925; received by the Editor, 31st December, 1925; issued separately, 17th November, 1926.*]

Since the publication of "Ustilaginaceae, or Smuts of New Zealand" (*Trans. N.Z. Inst.*, vol. 55, pp. 397-433, 1924) and the third supplement (*Ibid.*, vol. 56, p. 74) the following species has been collected.

Ustilago hypodytes (Schlecht.) Fries, *Syst. Myc.*, vol. 3, p. 518, 1832.

Caeoma hypodytes Schlecht., *F. Berol.*, vol. 2, p. 129, 1824.
Ustilago Sporoboli Ell et Ev., *Bull. Torr. Bot. Club*, vol. 24, p. 282, 1897. *U. funalis* Ell. et Ev., *l.c.*, p. 457.
Sorosporium Williamsii Griff., *Ibid.*, vol. 29, p. 296, 1902.

Sori enveloping internodes, developing progressively from the base upwards, at first enclosed by the leaf-sheaths, otherwise naked, at maturity olivaceous and pulverulent.

Spores subglobose, elliptical or irregular, often guttulate, 4-7.5 mmm; epispore perfectly smooth, olivaceous, 0.5 mmm. thick.

Host: *Agropyron repens* Beauv. On internodes.
Distribution: Britain; Europe; Asia; Africa; North and South America; New Zealand.
Windsor, North Otago, Dec. 1925, *J. C. Neill; F. E. Ward!*

The species forms long sori, often extending the whole length of the internode, covering it completely with the olivaceous, pulverulent spore mass. It is readily recognised on this account, being the only species present in New Zealand attacking this part of the host. It is absent from the inflorescences.

This is the first record of this smut from Australasia, but it would appear to be abundant in Europe and North America, where it has been recorded on numerous species and genera of the Gramineae.

ADDITIONAL UREDINACEOUS HOSTS.

Uredo Scirpi-nodosi McAlp. (*T.N.Z.I.*, vol. 55, p. 42, 1924).
Host: *Scirpus sulcatus* Thouars.
Te Kuiti, Auckland, Dec. 1905, *D. Petrie!*

The writer is indebted to Mr. E. H. Atkinson for bringing this host to his notice. It was in a collection made by the late Dr. D. Petrie, now in the herbarium of the Biological Laboratory, Dept. of Agriculture.

Aecidium otagense Linds. (*l.c.*, p. 33.)
Host: *Clematis foetida* Raoul. (Juvenile form).
Feilding, Wellington, Dec. 1925, *H. H. Allan!*

In this collection the rust has produced only slight inflations, up to 2.5 cm. long, on the stems, the large inflations, so characteristic of this species on *Clematis indivisa*, being absent.

Lycoperdaceae of New Zealand.

By G. H. CUNNINGHAM, Government Mycologist, Wellington.

[*Read before the Wellington Philosophical Society, 4th October, 1925; received by the Editor, 31st December, 1925; issued separately, 19th November, 1926.*]

A natural family of the Gasteromycetes is the Lycoperdaceae, containing eight genera, most of the species of which have a wide distribution. In the family are included those fungi popularly known as "puff-balls," some of which are among the largest fungi known.

The writer would limit the family to those genera possessing a non-stipitate, two or more layered peridium, copious capillitium, and long-sterigmate, 4 or 8 spored basidia.

In the past many more genera were included in the family, for the earlier workers arranged genera on external characters only; consequently when microscopic structure came to be studied, it was gradually realized that many genera were in an anomalous position, with the result that they were removed to other families and orders. It is considered unnecessary to give the different classifications which have been put forward, for all but the most recent are of interest only from an historical point of view.

The writer would divide the family into the two sub-families:—

Sub-family Lycoperdeae:
Peridium two-layered, dehiscing by an apical stoma or by the gradual falling away of the upper portions of the peridium; capillitium present, attached or free, simple or freely branched; basidia sterigmate, 4-spored.

Sub-family Geastreae:
Peridium three-layered, dehiscing by a definite apical stoma, or by several; capillitium present, simple, attached; basidia sterigmate, 4-8 spored.

STRUCTURE OF THE MATURE PLANT.

In species of the genera included in the sub-family Lycoperdeae, the mature plant consists of a two-layered peridium (exoperidium and endoperidium) either attached to the substratum by a rooting base (*Bovistella, Calvatia, Lycoperdon* and *Mycenastrum*) which holds plants to the place of origin even though they may be old and weathered; or the plant may be attached by a small rooting strand or mycelial cord, and at maturity break away and be carried by wind for some distance (*Abstoma, Bovista* and *Disciseda*). The outer layer of the peridium (the exoperidium) is usually pseudoparenchymatous, but may be membranous, and is often composed of warts and spines adherent at the base. This structure is usually quite thin, and in the majority of species flakes away in irregular patches.

In *Abstoma* and *Disciseda* the exoperidium is frequently in the nature of a thick (1-3 mm.) sand-case, consisting of loosely interwoven hyphae with which are immixed sand particles. The whole structure is firm but quite brittle, and falls away in irregular fragments.

The inner layer (the endoperidium) is in most genera thin and membranous or papyraceous, but in *Mycenastrum* is thick (2·5 mm.), corky, coriaceaus and pseudoparenchymatous, and in young plants may appear almost cartilaginous.

The peridium encloses the gleba, which at maturity consists of capillitium threads and spores. The threads are discussed more fully below, and serve as most useful generic characters. In many species of the genera *Bovistella* and *Lycoperdon* is present the so-called columella, a cylindrical or elliptical structure of sterile tissue traversing the lower portion of the gleba and attached to the base of the plant. In certain species of the genera *Bovistella, Calvatia* and *Lycoperdon* a sterile base is present. This consists of a (usually) cellular tissue occupying the lower portion of the gleba, and is most frequent in those plants with a well-developed stem-like base. In certain species of *Calvatia* and *Lycoperdon* the sterile base is separated from the gleba by a definite diaphragm.

The spores are globose or shortly elliptical, and possess rough or smooth epispores. Their shape, size, colour and degree of roughness are useful specific characters. They are borne on long and slender sterigmata which in turn are borne apically on small basidia. Should the sterigmata with their attached spores break away from the basidia and remain attached to the spores, the latter are said to be pedicellate; should stumps only of the sterigmata remain attached to the spores the latter are said to be apiculate; or, should the spores become completely detached from the sterigmata, they are said to be apedicellate. The basidia in all members of this sub-family are regularly tetrasporous.

In the genus *Geaster*, placed in the sub-family Geastreae, the structure of the mature plant is complicated in that no less than three well-defined tissues form the exoperidium—an outer mycelial layer consisting of a palisade of short, stout fibres, a central fibrillose layer of interwoven hyphae with long axes predominantly radial, and an inner fleshy layer, definitely pseudoparenchymatous in structure. The basidia are long-sterigmate and commonly 8-spored.

Genera of the sub-family Lycoperdeae show a close family resemblance, so close in fact that difficulty is sometimes experienced in separating species—as for example species of *Calvatia* from *Lycoperdon*. Separation is best effected by means of the capillitium threads and method of dehiscence. In *Calvatia* and *Lycoperdon* these threads are very long, even throughout their length, sparingly septate or continuous, and seldom branched (save in certain species of the latter genus, as *Lycoperdon pusillum, L. glabrescens* which are freely branched). The threads are usually free at one end, and attached by the other to the inner wall of the peridium and (when present) a central columella.

Calvatia is separated from *Lycoperdon* by the method of dehiscence. In the former genus the upper portions of the peridium flake away in pieces, so that at maturity the whole may have disappeared, the gleba then being directly exposed. In *Lycoperdon* dehiscence is effected by a definite apical aperture or stoma. In two species, the dehiscence is first effected by means of an apical stoma, but as the plant ages, irregular flaking away of the whole of the apex of the

peridium occurs; consequently difficulty might be experienced in placing plants of these species according to whether they were collected when mature or immature.

In *Abstoma* and *Disciseda* the capillitium threads are very short, unbranched, and usually continuous, and are so characteristic as usually to place any species in these two genera. In immature plants, however, the capillitium threads approach those of *Lycoperdon,* and in such cases the nature of the exoperidium and the habit show them to be members of these genera. Dehiscence in *Disciseda* is effected by a stoma which is usually apical, but in one or two species is said to be basal. In *Abstoma* no stoma is present, the spores being freed by the irregular rupture of the endoperidium.

Bovista and *Bovistella* both possess capillitium threads which are peculiar and characteristic. Each thread is free, and has a distinct short, thick main stem with numerous short, dichotomous, acuminate branches. Dehiscence is effected by means of an apical stoma as in *Lycoperdon.* The two genera are separated from each other only upon habit, *Bovista* being a genus in which plants break away at maturity from the place of growth, *Bovistella* persisting by means of a strong rooting base, as does *Lycoperdon.* Herbarium specimens may usually be differentiated by the presence or absence of the rooting base; if present the plant is placed under *Bovistella,* if absent, under *Bovista.*

Mycenastrum is characterised both by the capillitium threads and method of dehiscence. The threads are short, free, short-branched, and covered with numerous spinous processes. Dehiscence is similar to that of *Calvatia,* the corky peridium either flaking away irregularly from the apex, or splitting in a stellate manner.

In *Geaster* dehiscence is effected by the exoperidium (of three layers) splitting at maturity from the apex downwards into several stellate lobes, exposing the endoperidium, which in turn dehisces by an apical stoma. The capillitium threads resemble those of the genus *Lycoperdon,* but are usually continuous, simple, and dark coloured.

KEY TO THE GENERA.

Sub-family Lycoperdeae: Peridium 2-layered, basidia 4-spored.

a. Capillitium threads attached to the endoperidium and central columella, when present.

(*a*). Peridium dehiscing by irregular apical rupture .... 1. *Calvatia*

(*b*). Peridium dehiscing by a definite apical stoma .... 2. *Lycoperdon*

b. Capillitium threads free within the endoperidium.

(*a*). Threads simple, or short-branched

*Threads short, simple, smooth.

†Stoma present, apical or basal 5. *Disciseda*

‡Stoma absent .... 6. *Abstoma*

**Threads short, simple, spinose .... 7. *Mycenastrum*

(*b*). Threads freely branched, of a central main stem, and short, dichotomous, acuminate branches.

*Plants with a strong rooting base 3. *Bovistella*

**Plants without a definite rooting base .... 4. *Bovista*

Sub-family Geastreae: Peridium 3-layered, basidia 4-8 spored.

*Peridium with a single apical stoma	8. *Geaster*.
**Peridium with several apical stomata	(*Myriostoma*)

(1) **Calvatia** Fries, *Summa Veg. Scand.*, p. 442, 1849.

Peridium globose, subglobose or pyriform, frequently with a well-developed rooting base; of two layers, an outer exoperidium which is warted, spinose, granular or smooth, and flakes away in irregular patches; and an inner endoperidium which is thin, papyraceous or membranous, and dehisces by the gradual flaking away of the apical portion; with or without a sterile base; distinct diaphragm present or absent.

Gleba of capillitium and spores; columella absent; capillitium threads long, sparingly branched or simple, equal, septate or continuous, attached to the inner wall of the endoperidium. Spores globose or elliptical, coloured, rough or smooth, continuous.

Habitat: Solitary or in small groups on the ground in pastures, sand-dunes or outskirts of the forest; epigaean.
Distribution: Britain; Europe; Asia; North and South America; India; Africa; Australia; New Zealand.

The genus is separated from *Lycoperdon* solely by the method of dehiscence, which is effected by the irregular breaking away of the upper portion of the endoperidium. Its relationship was obscure until its position and limits were defined by Morgan (1890). In it are included most of the largest species of "puff-balls."

About eight species are known, three of which are present in New Zealand.

KEY TO THE SPECIES.

Diaphragm present:	
Spores smooth	1. *C. caelata*
Spores strongly verrucose	2. *C. lilacina*
Diaphragm absent	3. *C. gigantea*

1. **Calvatia caelata** (Bulliard) Morgan, *Jour. Cin. Soc. Nat. Hist.*, vol. 12, p. 169, 1890. (Fig. 1.)

Lycoperdon caelatum Bull., *Champ.*, vol. 1, p. 156, 1809.
L. Fontanesii Dur. et Mont., *Fl. Alger.*, vol. 1, p. 381, 1849.
L. favosum Bon., *Bot. Zeit.*, vol. 15, p. 595, 1857.
L. Sinclairii Berk., Mass., *Jour. Roy. Micr. Soc.*, p. 176, 1887.
Calvatia Fontanesii (D. et M.) Lloyd, *Lyc. Aus.*, p. 36, 1905.
C. favosa (Bon.) Lloyd, *l.c.*
C. Sinclairii (Berk.) Lloyd, *l.c.*, p. 37.

Peridium up to 10 cm. diam., depressed-globose or subpyriform, tapering abruptly into a well-developed, crenulate, stem-like rooting base; exoperidium at first white, becoming pallid olivaceous, areolate, floccose, areolae more conspicuous basally; endoperidium brown, fragile, breaking away in irregular flakes from the apical portion; sterile base well developed, persistent, forming the lower third of the peridium, distinctly cellular throughout, separated from the gleba by a well-defined diaphragm.

Gleba at first yellowish, becoming olivaceous, at first compact, becoming pulverulent; capillitium threads long and flexuous, sparsely branched, septate, olivaceous. Spores globose, 4-5 mmm. diam., frequently apiculate; epispore olivaceous, perfectly smooth.

Habitat: Solitary on the ground, frequent on sand-dunes near the sea coast.

Distribution: Britain; Europe; North America; Algeria; Australia; New Zealand.

Queenstown, Otago, May, 1920, *J. B. Cleland!*

Otaki, Wellington, Nov., 1924, *E. H. Atkinson!*

The plant is characterised by the areolate exoperidium, perfectly smooth spores, prominent diaphragm, and large, cellular base.

2. **Calvatia lilacina** (Berk. et Mont.) Lloyd, *Lyc. Aus.*, p. 35, 1905. (Fig. 3.)

Bovista lilacina Berk. et Mont., in Hook. *Jour. Bot.*, vol. 4, p. 62, 1845.

Lycoperdon novae- zelandiae Lev., *Ann. Sci. Nat.*, ser. 3, vol. 5, p. 164, 1846.

L. lilacinum (B. et M.) Massee, *Jour. Roy. Micr. Soc.*, p. 706, 1887.

Calvatia cyathiformis (Bosc.) Morgan, *Jour. Cin. Soc. Nat. Hist.*, vol. 12, p. 168, 1890.

Peridium up to 15 cm. diam., subglobose or pyriform, tapering abruptly into a large, well-developed, strongly crenulate rooting base; exoperidium smooth or more frequently floccose, often areolate, cream to bay brown, thin, fragile, fugacious; endoperidium brown, thin, fragile, breaking away irregularly from the apical portion; sterile base well developed, persistent, cellular at the periphery, hemicompact within, separated from the gleba by a prominent diaphragm. Gleba some shade of purple, sometimes with a greyish tinge, at first compact, soon pulverulent; capillitium threads long, branched, septate, equal, pallid olivaceous. Spores globose, 5.5-7.5 mmm. diam., occasionally apiculate; epispore strongly verrucose, violaceous.

Habitat: Solitary on the ground, usually in sandy areas.

Distribution: ? Southern Europe; North America; South Africa; Australia; New Zealand.

Weraroa, Wellington, Oct., 1922, *G. H. C.;* Mar., 1925, *J. C. Neill!*

Dunedin, Otago, Sept., 1922, *Miss H. K. Dalrymple!*

Otaki Beach, Wellington, Nov., 1924, *E. H. Atkinson!*

Characterized by the prominent sterile base, conspicuous diaphragm, and especially by the strongly verrucose, violaceous spores. The peridium and gleba are fragile, consequently the sterile base is often the only portion of the plant collected; nevertheless even this can be determined readily owing to its structure. It is liable to confusion only with that of *C. caelata,* but may be separated by its peculiar, partly compact, partly cellular structure.

The peridium is usually stated to be smooth externally, but this is by no means a constant feature; on the contrary, collections frequently show the exterior to be floccose and even areolate.

3. **Calvatia gigantea** (Persoon) n. comb. (Fig. 2.)

Lycoperdon giganteum Pers., *Syn. Meth. Fung.*, p. 140, 1801.
Bovista gigantea (Pers.) Nees, *Syst. Pilze*, p. 34, 1817.
Lycoperdon Bovista Fr., *Syst. Myc.*, vol. 3, p. 29, 1829.
Calvatia maxima (Schaeff.) Morg., *Journ. Cin. Soc. Nat. Hist.*, vol. 12, p. 166, 1890.
C. gigantea (Batsch) Lloyd, *Myc. Notes*, p. 166, 1904.
C. primitiva Lloyd, *Lyc. Aus.*, p. 36, 1905.

Peridium subglobose, up to 40 cm. diam., with a cord-like rooting base; exoperidium smooth, finely tomentose, closely resembling chamois leather, fragile, cream or yellowish, fugacious; endoperidium brown, thin, fragile, flaking away irregularly; sterile base scanty, compact, frequently wanting, diaphragm absent.

Gleba yellowish, becoming olivaceous, hemi-compact; capillitium threads long, sparingly branched, septate, olivaceous. Spores globose, 4-5.5 mmm. diam., occasionally apiculate; epispore olivaceous, finely verruculose.

Habitat: Solitary on the ground in pastures.

Distribution: Britain; Europe; North America; Australia; New Zealand.

New Plymouth, Taranaki, Dec., 1923, *W. W. Smith!*
Weraroa, Wellington, Mar., 1925, *J. C. Neill!*
Ashburton, Canterbury, Jan., 1926, *J. C. Neill!*

The (usually) very large size, leathery peridium and absence of a well developed sterile base characterizes this species. No diaphragm is present, consequently the scanty sterile base merges imperceptibly with the tissues of the gleba. The spores are usually stated to be smooth, but are seen to be distinctly verruculose under the oil immersion.

This is the commonest species in New Zealand, and may regularly be found during the spring and autumn months in certain pastures in the lowland areas. All three species are edible, if collected and eaten while the gleba is white.

(2) **Lycoperdon** Tournefort ex Persoon, *Syn. Meth. Fung.*, p. 138, 1801.

Utraria Quel., *Bull. Soc. Myc. Fr.*, vol., 24, p. 366, 1876.
Globaria Quel., *l.c.*, p. 370.

Peridium variously shaped, with a strong rooting base or basal mycelial strand; of two layers, a fugacious exoperidium which is pseudoparenchymatous, warted, spinose or granular; and a persistent endoperidium which is membranous or papyraceous, thin, tough, and dehisces by a solitary apical stoma; sterile base present or absent, cellular or compact, diaphragm present or absent.

Gleba of capillitium and spores; columella present or absent; capillitium threads long, simple or branched, continuous or septate, hyaline or coloured, attached by one end to the endoperidium or columella, when present. Spores continuous, globose or shortly elliptical, rough or smooth, coloured.

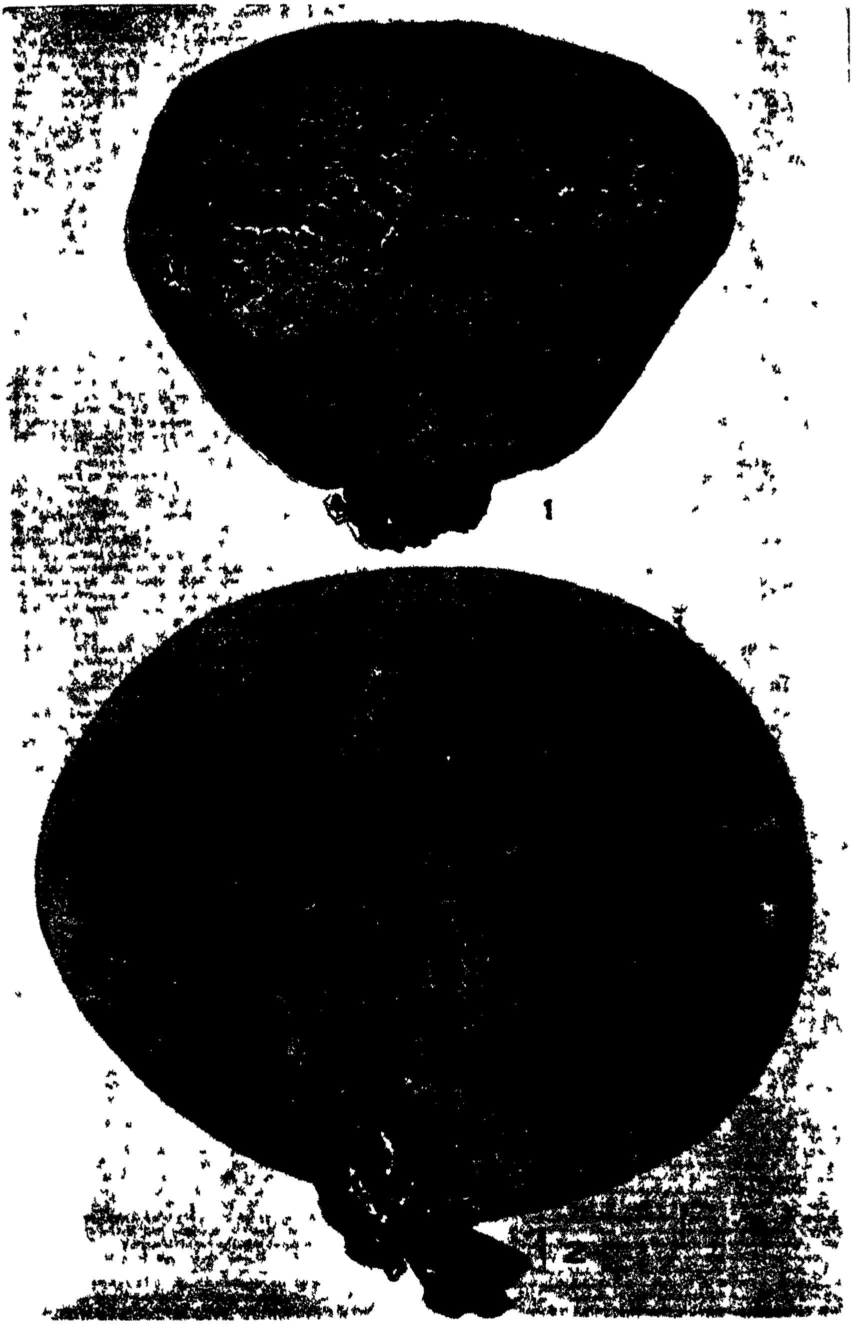
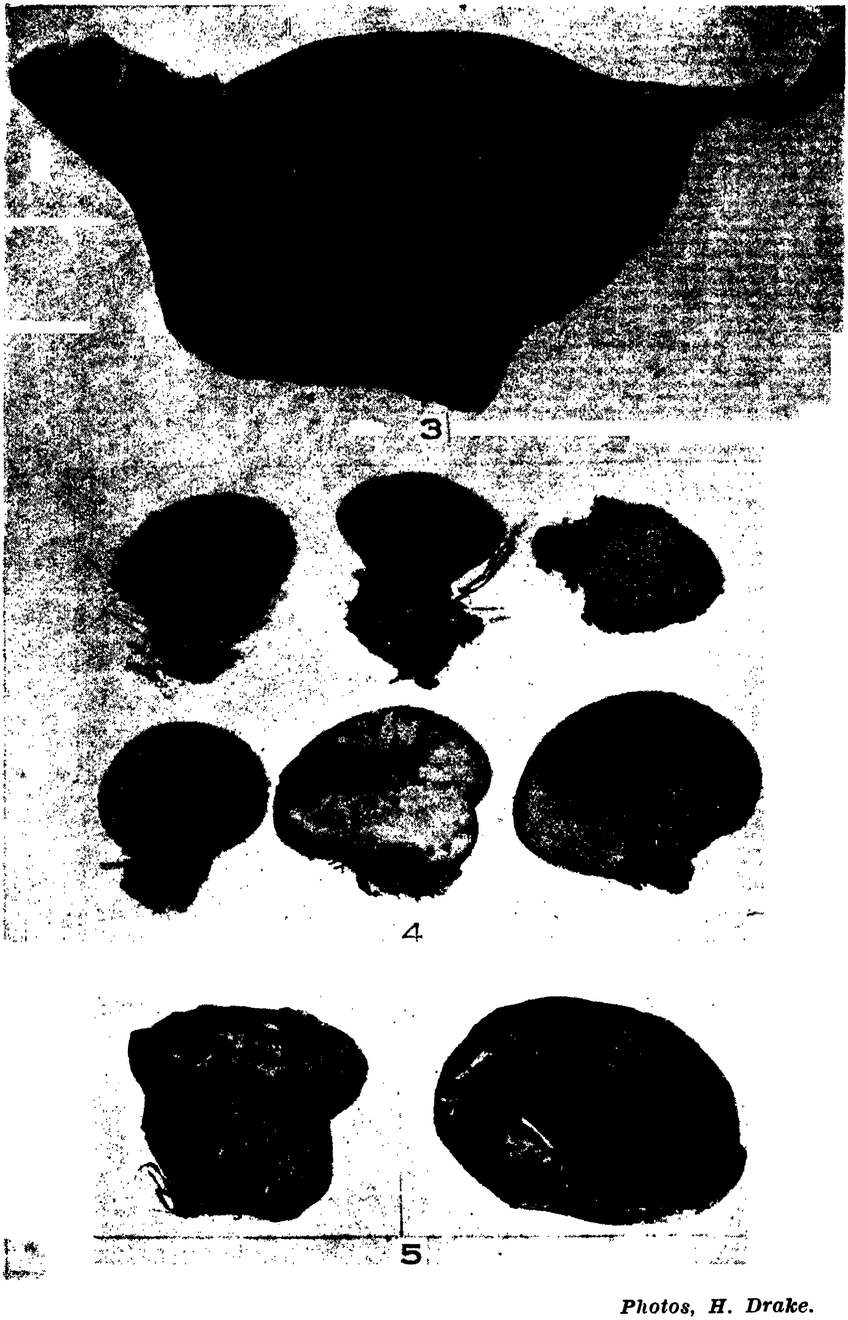
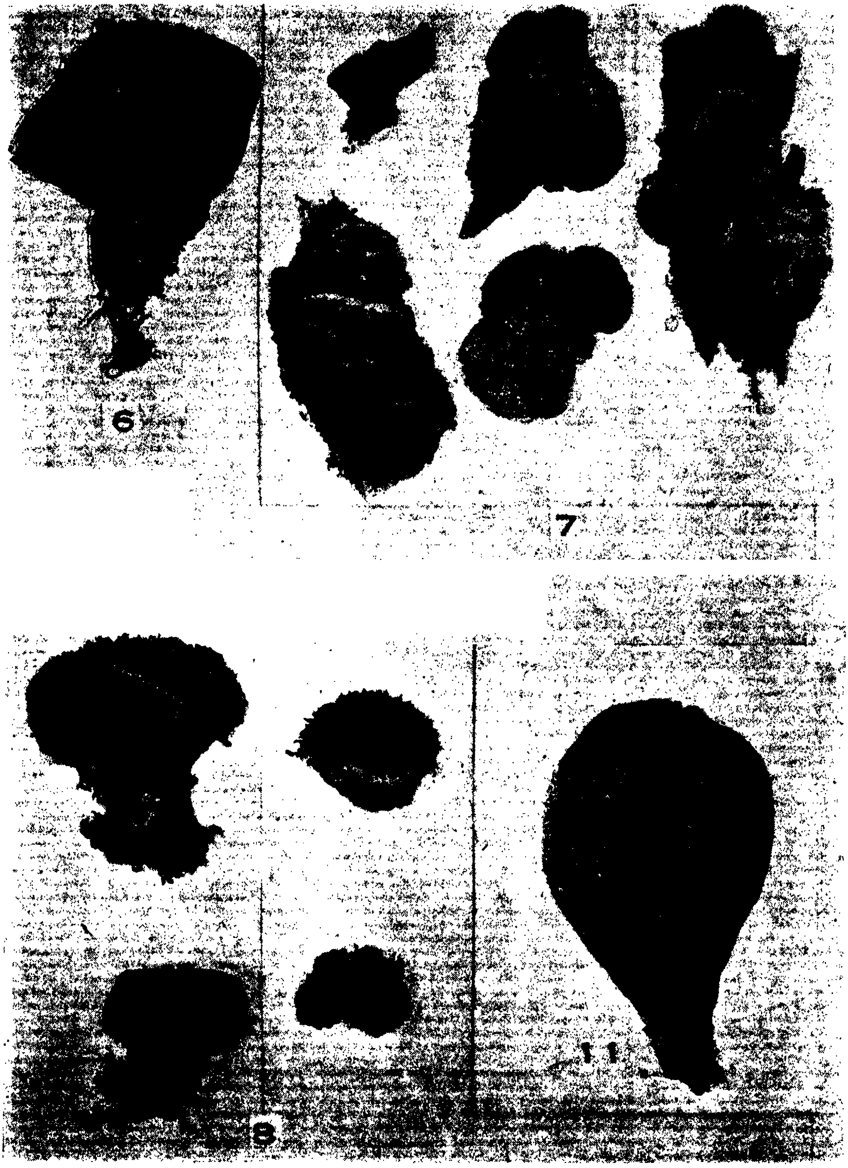


Fig. 1.—*Calvatia caelata*, natural size. *Photos, H. Drake.*
Fig. 2—*Calvatia gigantea*, × ½. Small form.



Photos, H. Drake.

FIG. 3.—*Calvatia lilacina*, natural size. Sterile base; note the conspicuous diaphragm.
FIG. 4.—*Lycoperdon depressum* × ½. Showing variations in the nature of the exoperidium.
FIG. 5.—*Lycoperdon depressum*, natural size. Showing the prominent sterile base and the manner in which the endoperi-



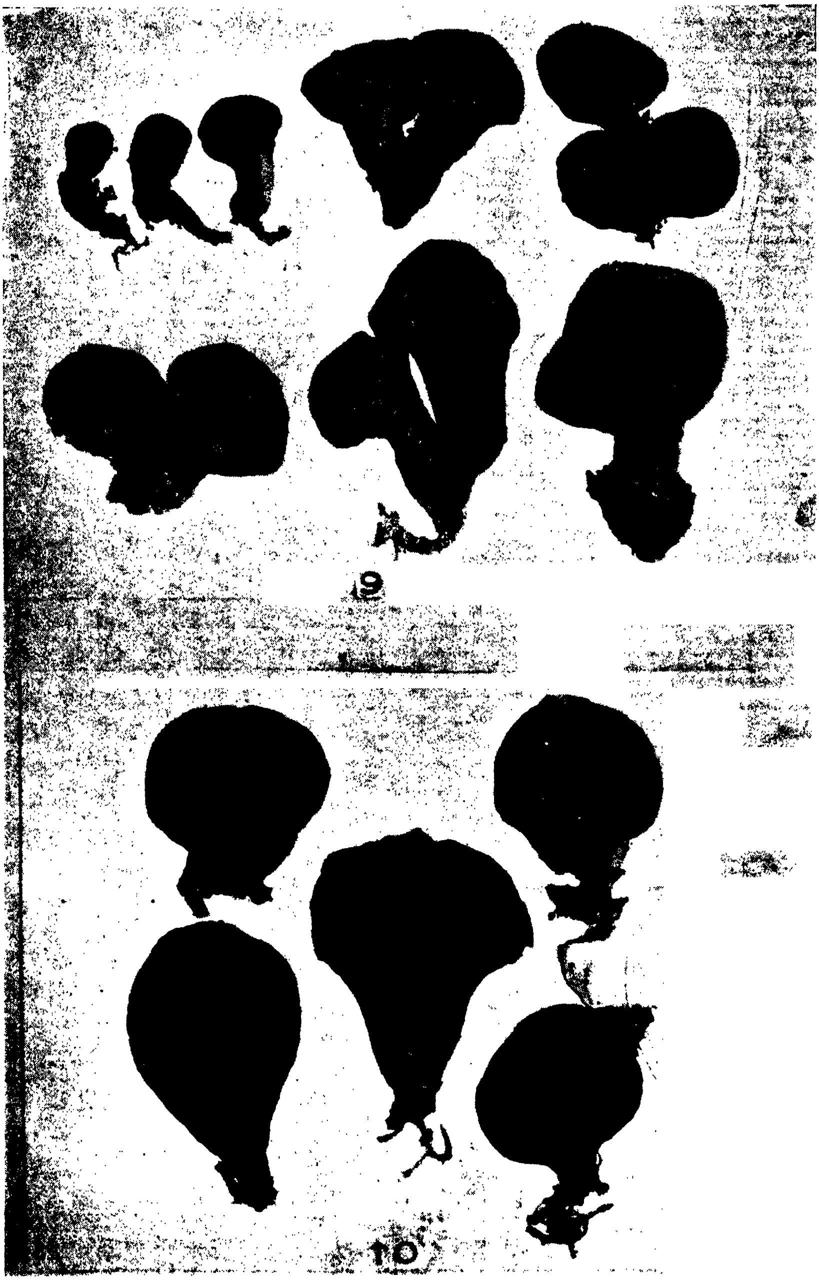
Photos, G. H. Cunningham.

FIG. 6.—*Lycoperdon depressum*, natural size. Showing the prominent diaphragm separating the gleba from the sterile base.

FIG. 7.—*Lycoperdon compactum*, natural size. Showing the caespitose habit, and ligneous habitat.

FIG. 8.—*Lycoperdon compactum*, × 2. Showing the spines of the exoperidium and, where these have fallen away, the reticulations on the endoperidium.

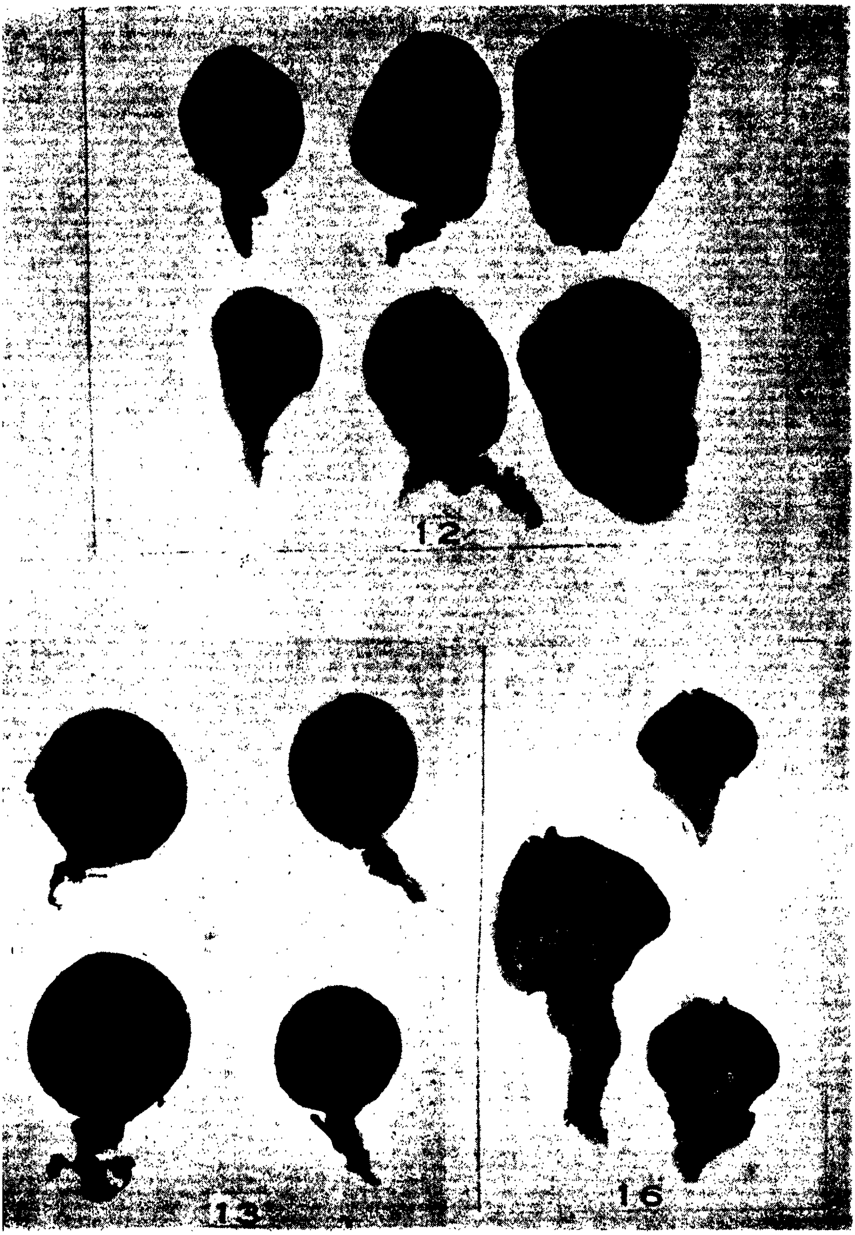
FIG. 11.—*Lycoperdon piriforme*, natural size. Note the minute granules of the exoperidium.



Photos, G. H. Cunningham.

FIG. 9.—*Lycoperdon perlatum*, × ⅓. Showing the range and shape. Scars left by fallen verrucae are shown on several. Note also the caespitose habit.

FIG. 10.—*Lycoperdon piriforme*, × ½.

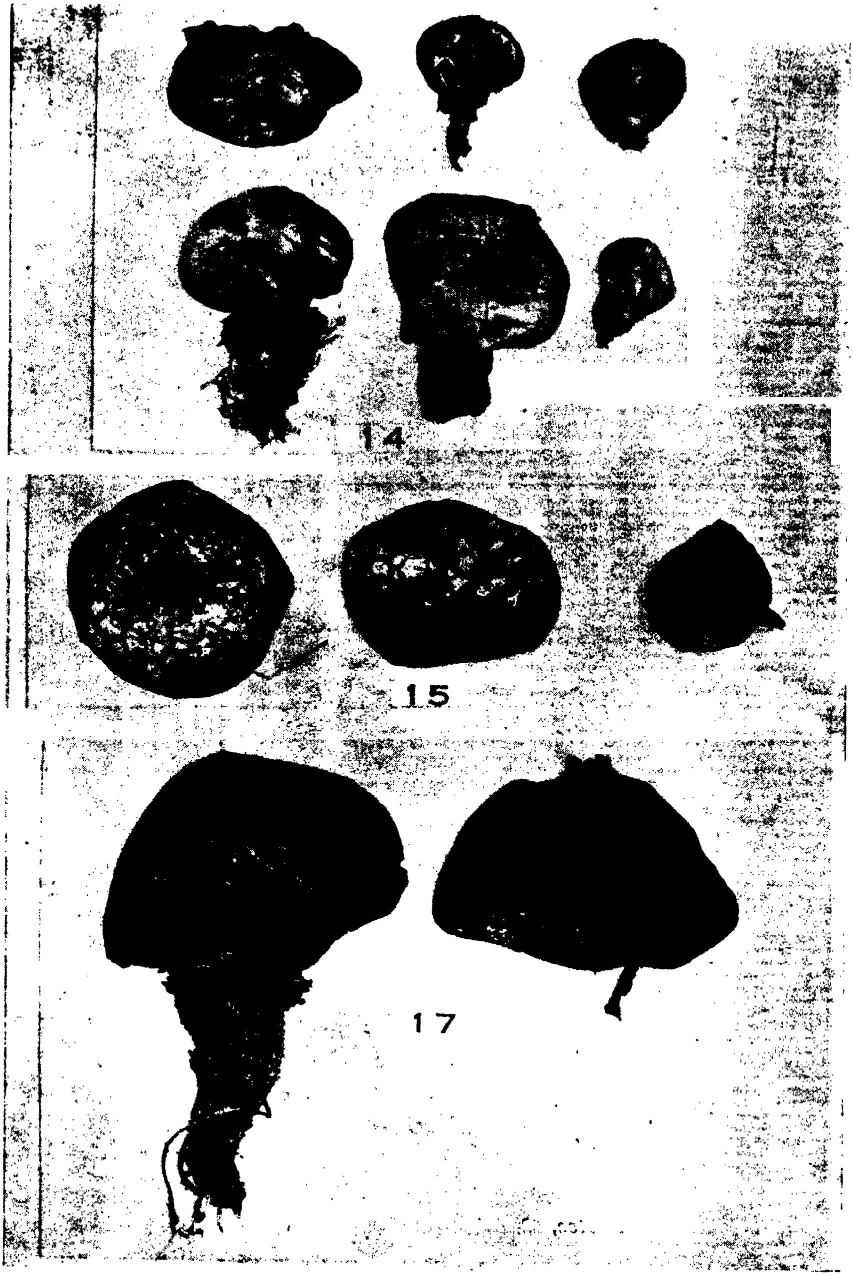


Photos, 12 and 16 by G. H. Cunningham, 13 by H. Drake.

Fig. 12.—*Lycoperdon polymorphum*, × ½. Note the almost glabrous exterior.

Fig. 13.—*Lycoperdon pusillum*, × 2. Note the furfuraceous exoperidium and prominent rooting strand.

Fig. 16.—*Lycoperdon scabrum*, natural size. Showing the nature of the exoperidium.

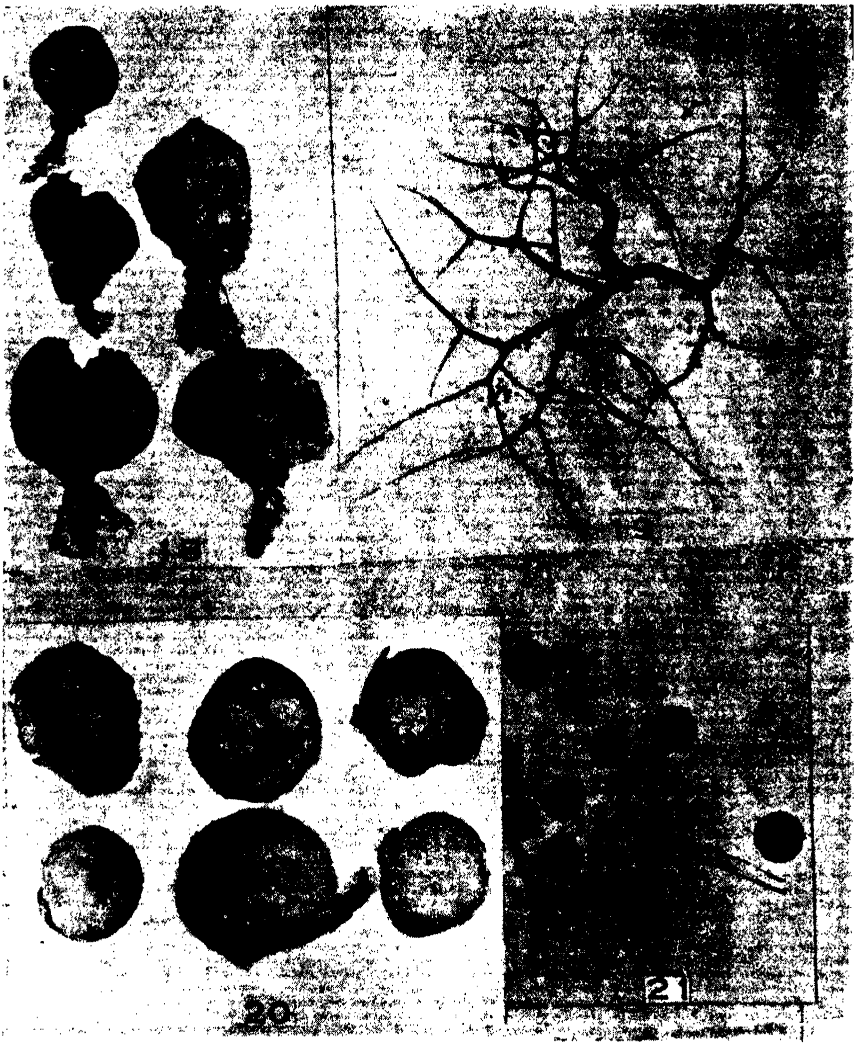


Photos, 14 by G. H. Cunningham, 15 and 17 by H. Drake.

FIG. 14.—*Lycoperdon glabrescens*, × ½. Note the glabrous endoperidium.

FIG. 15.—*Bovista brunnea*, natural size. Note the areolate nature of the peridium of this collection.

FIG. 17.—*Lycoperdon scabrum*, × 2. Showing the sterile base and prominent rooting base.



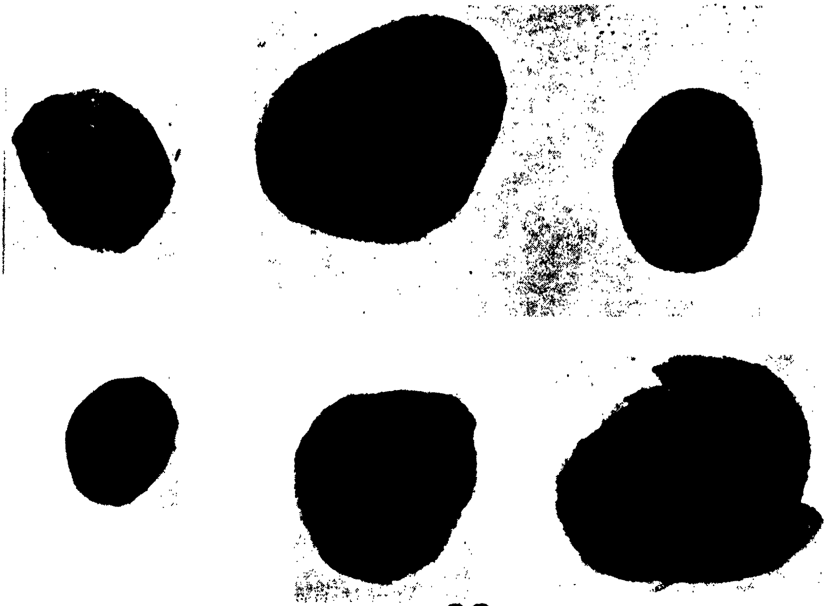
Photos, G. H. Cunningham.

FIG. 18.—*Lycoperdon spadiceum*, natural size. Section showing the cellular sterile base in left centre; this collection is more furfuraceous than usual. White objects in gleba are insect larvae.

FIG. 19.—*Bovista purpurea*, capillitium × 110.

FIG. 20.—*Bovista purpurea*, × [illegible]. Note the partially persistent exoperidium.

FIG. 21.—*Abstoma purpureum*, capillitium and spores, × 540.



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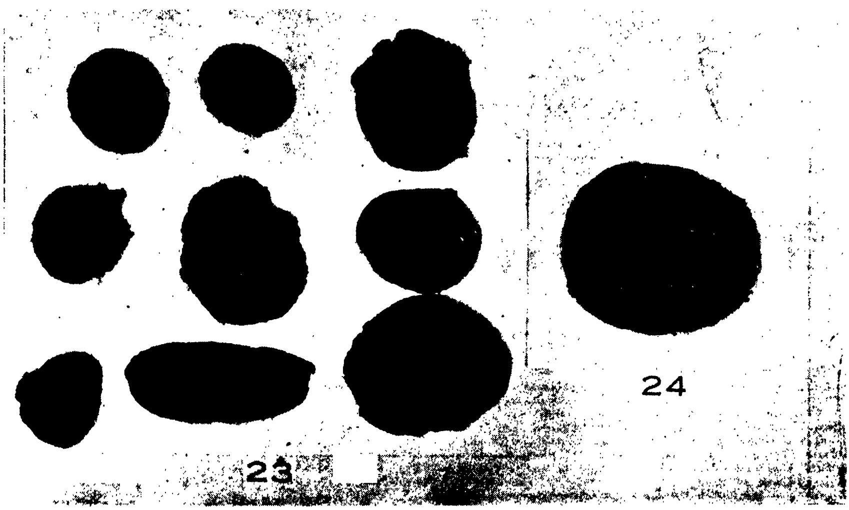


Photos, 22 by H. Drake, 23 and 24 by G. H. Cunningham.

FIG. 22.—*Abstoma purpureum*, natural size. Note the thick, sand-case exoperidium (lower right), thin nature of the endoperidium, and the manner in which the exoperidium is worn through by sand erosion (top right).

FIG. 23.—*Disciseda candida*, × ¾. Note the persistent exoperidium, reticulate, gelatinous layer and fimbriate, mammose stoma.

FIG. 24.—*Disciseda verrucosa*, natural size.

Photos, 26 by G. H. Cunningham, others by H. Drake.

FIG. 25.—*Mycenastrum corium*, $\times \frac{2}{3}$. Showing the thick endoperidium and stellate method of dehiscence.

FIG. 26.—*Mycenastrum corium*, capillitium $\times$ 125. Showing the spinose nature of the threads; air bubbles in the lumen of the threads show dark in the photo.

FIG. 27.—*Geaster pectinatus*, natural size. Showing the sulcate peristome.

FIG. 28.—*Geaster plicatus*, natural size.

FIG. 29.—*Geaster minus*, natural size.

Photos, H.. Drake.

Fig. 30.—*Geaster limbatus*, typical form. Natural size.
Fig. 31.—*Geaster limbatus*, natural size. Farinose, sub-hygroscopic form.
Fig. 32.—*Geaster limbatus*, natural size. This Lloyd has named *G. rufescens.*
Fig. 33.—*Geaster velutinus*, natural size. Typical form in the centre; freshly expanded plant on the right.

Photos, 35 by G. H. Cunningham, others by H. Drake.

FIG. 34.—*Geaster velutinus*, natural size. Exterior of exoperidium showing its tomentose nature and prominent umbilical scar.

FIG. 35.—*Geaster triplex*, × ½.

FIG. 36.—*Geaster triplex*, × ½. Showing the glabrous exterior of the exoperidium.

FIG. 37.—*Geaster floriformis*, natural size. Note the strongly hygroscopic exoperidium.

Habitat: Solitary, in groups, or caespitose on the ground or upon rotting wood in pastures or in the forest; epigaean.
Distribution: World-wide.

A cosmopolitan genus found in practically every country in the world. It is a difficult one for the systematist, as different plants in the same collection may vary to such an extent as to make specific delimitation often a matter of difficulty.

In the past most species were erected upon such variable characters as the colour of the gleba, size and shape of the peridium, nature of the exoperidium, and presence or absence of a sterile base. To-day these are not considered of specific import unless well characterized, for the colour of the gleba would appear to depend upon the age of the plants at the time they were collected; if gathered when immature, the gleba may be yellow, the olivaceous or purple colour appearing only in the mature plant. The size and shape of the peridium are also of little value as specific characters, for in *Lycoperdon polymorphum* plants range in size from minute forms the size of a pea to large forms 6 cm. or more in diameter; the shape may range from globose, through pyriform to turbinate. The sterile base is also a variable character, for in the same collection may be plants in which this structure is strongly developed or almost wanting. Finally the exoperidium may in the same collection be spinous, verrucose, or almost granular (*L. depressum*), yet upon the degree of roughness of the exoperidium most species have been erected.

Various attempts have been made to subdivide the genus. For example Quelet erected the genus *Globaria* to contain those species without a sterile base—a character which was previously used by Persoon to separate *Bovista* from *Lycoperdon*. This character cannot be considered of generic value, however, for as has been pointed out, the sterile base may be present or absent in different plants of the same collection, being in fact one of the most variable features of the genus.

More recently Lloyd (1905, *a*) has separated from *Lycoperdon* and placed under *Bovistella* all plants possessing a rooting base together with pedicellate spores or capillitium of the *Bovista* type, or both. The result has been to take away species with typical *Lycoperdon* capillituim, and place them under *Bovistella*, solely because the spores were pedicellate. In the Lycoperdeae the capillitium is the most satisfactory character by which most of the genera may be separated, consequently such treatment does not aid the systematist.

Owing to the different opinions held by systematists regarding the specific value of many of the characters discussed, it is difficult to obtain any idea as to the number of species extant, for this number varies considerably with different workers; for example Massee (1887) discusses no less than 129 species! Probably the number is in the vicinity of 30, for the modern tendency is to reduce rather than to increase the number, the many others that have been proposed being now considered as variable forms of these.

In New Zealand there are nine well-marked species, recognisable in that they can be "keyed," for the writer believes this to be the final test of a species.

Key to the Species.

A. Spores without definite pedicels

- **a. Diaphragm present, separating the gleba from the prominent sterile base** .... 1. *L. depressum*
- b. Diaphragm absent
  - (*a*). **Sterile base cellular, usually well developed**
    - *Capillitium hyaline .... 2. *L. compactum*
    - **Capillitium deeply coloured
      - †Capillitium sparingly branched, or simple
        - 1. Exoperidium of minute connivent spines .... 3. *L. piriforme*
        - 2. Exoperidium of conspicuous pointed verrucae .... 4. *L. perlatum*
      - ‡Capillitium freely branched .... 5. *L. spadiceum*
  - (*b*). Sterile base compact, not cellular 6. *L. polymorphum*
  - (*c*). Sterile base absent .... 7. *L. pusillum*

B. Spores long-pedicellate

- *a*. Exoperidium furfuraceous .... 8. *L. glabrescens*
- *b*. Exoperidium of long, cruciate spines 9. *L. scabrum*

1. **Lycoperdon depressum** Bonorden, *Bot. Zeit.*, vol., 15, p. 611, 1857. (Figs. 4, 5, 6.)

Peridium yellow, becoming pallid brown, up to 5 cm. diam., elliptical, obconic or subturbinate, frequently constricted towards the base and plicate; exoperidium of white spines united at their apices, immixed with numerous simple spines and granules, larger and more numerous basally, partially disappearing with age; endoperidium yellow-brown, dehiscing by a definite apical stoma, later the whole of the apical portion falling away; sterile base occupying the lower third of the peridium, bay brown or umber, of large cells, separated from the gleba by a well-defined diaphragm.

Gleba yellowish, becoming pallid olivaceous; columella absent; capillitium threads hyaline, simple or sparingly branched, septate, not pitted. Spores globose, 3-5.5 mmm. diam., apedicellate; epispore pallid olivaceous, finely and closely verrucose.

Habitat: Solitary or in small groups on the ground, often forming rings in pastures.

Distribution: Britain; Europe; South Africa; Australia; New Zealand.

Queenstown, Otago, May, 1922, *J. B. Cleland!*
Rotorua, Auckland, June, 1919, *J. Barr!*
Tasman, Nelson, Feb., 1922, *G.H.C.*
Mapua, Nelson, May, 1922, *G.H.C.*
Tapanui, Otago, Mar. 1923, *G.H.C.*
Dun Mt., Nelson, June, 1923, *J. C. Neill!*
Whakatikei, Wellington, June, 1923, *J. C. Neill!*
Weraroa, Wellington, May, 1924; Mar., 1925, *J. C. Neill!*
Ashburton, Canterbury, Jan., Feb., Mar., Aug., 1925, *J. C. Neill!*

The species is characterised by the prominent diaphragm, large, cellular base, and hyaline, freely septate, simple or sparingly branched capillitium. It is the most abundant species in New Zealand and Australia, is apparently common in Europe, but strangely

absent from North America, where it appears to be replaced by a form Lloyd has named *L. sub-pratense*, separated by its coloured capillitium.

Lloyd (1905, *c*) states he believes this species is probably L. *hiemale* Vitt., and possibly *L. pratense* Pers., but has produced no evidence in support of this statement; nevertheless the species is regularly discussed in his works under the latter name.

2. **Lycoperdon compactum** n. sp. (Figs. 7, 8.)

Peridium up to 4 cm. diam., subglobose or pyriform, depressed above, compressed below into a short, stem-like base; exoperidium of strong brown spines, 3-4 mm. long, separate at the base, frequently connivent at the apices, surrounded by a ring of minute brown warts or granules, the spines partially disappearing with age, when the endoperidium appears reticulate from the presence of the persistent rings of granules; endoperidium membranous, ochraceous, becoming brown, dehiscing by an apical, plane, torn, small stoma; sterile base occupying the stem-like base, often rudimentary, minutely cellular, ochraceous; diaphragm absent.

Gleba olivaceous, pulverulent; columella small, elliptical; capillitium threads hyaline, sparsely branched or simple, septate, diameter of the spores, not pitted. Spores globose, 3.5-4.5 mmm. diam., with caducous pedicels up to 5 mmm. long; epispore olivaceous, closely and finely verrucose.

Habitat: In small groups or caespitose on rotting wood on the forest floor.

Distribution: New Zealand.

Lake Papaetonga, Wellington, Aug., 1919, *G.H.C.*

York Bay, Wellington, Feb., 1923, *E. H. Atkinson!* Type collection.

The species is characterized by the strongly spinous exoperidium, minutely cellular sterile base, hyaline, septate capillitium, and finely verrucose spores. It is peculiar in that it possesses certain characters of several species, for it has the exoperidium of *L. echinatum* Pers., a sterile base resembling that of *L. Hoylei* Berk., spores of *L. perlatum* Pers., and capillitium of *L. depressum* Bon.

The exoperidium is clothed with long (3-4 mm.) dark brown, almost black spines, which are free at their bases, but frequently connivent at their apices; at the base each is surrounded with a ring of numerous coloured granules. When the spines fall away, the endoperidium appears reticulate, owing to the presence of these rings of granules, which persist and form a net-like series of fine lines.

The habit of growing upon wood is also a feature of the plant, being peculiar to only one other New Zealand species, *L. piriforme*.

3. **Lycoperdon piriforme** Schaeffer ex Persoon, *Syn. Meth. Fung.*, p. 149, 1801 (Figs. 10, 11.)

Peridium up to 10 cm. diam., grey to bay brown, pyriform, subturbinate or subglobose, with a compressed, slender, stem-like base; exoperidium of fine, scattered, brown or black, persistent, pointed verrucae and granules; endoperidium brown, membranous, dehiscing

by an apical, small, plane, torn stoma; sterile base prominent, forming the stem-like base, cellular, pallid tan or yellowish; diaphragm absent.

Gleba greenish-yellow, becoming ferruginous or olivaceous; columella prominent, subglobose; capillitium threads olivaceous, sparingly branched or simple, continuous, about the diameter of the spores, not pitted. Spores globose, 3.5-4.5 mmm. diam., apedicellate; epispore pallid olivaceous, delicately verruculose.

Habitat: Solitary, in groups, or caespitose on rotting wood on the forest floor, or on standing stumps.

Distribution: Britain; Europe; North and South America; India; Japan; Australia; New Zealand.

Lake Papaetonga, Wellington, Aug., 1919, *G.H.C.*
Pokaka, Waimarino County, Feb., 1922, *D. Miller!*
Weraroa, Wellington, Aug., 1919, May, 1923, *G.H.C.*
Whakatikei, Wellington, June, 1923, *J. C. Neill!*
Day's Bay, Wellington, Apl., 1926, *D. W. McKenzie!*

Characterised by the minute verrucae of the exoperidium, the (usually) pyriform shape, almost smooth spores, and habit of growing upon rotting wood. It is liable to confusion only with *L. perlatum*, from which it may be separated by these characters.

4. **Lycoperdon perlatum** Persoon, *Syn. Meth. Fung.*, p. 148, 1801. (Fig. 9.)

L. gemmatum Batsch ex Auctt.
L. excipuliforme (Scop.) Vitt., *Mon Lyc.*, p. 49, 1842.
L. montanum Quel., *Champ. Dura*, p. 444, 1876.
L. Colensoi Cke. et Mass., *Jour. Roy. Micr. Soc.*, p. 711, 1887.
L. tasmanicum Mass., *Kew. Bull.*, p. 158, 1901.
L. macrogemmatum Lloyd, *Myc. Notes*, p. 265, 1906.

Peridium up to 6 cm. diam., yellowish, becoming bay-brown, subglobose, pyriform or turbinate, often tapering into a cylindrical stem-like base; exoperidium of white verrucae, surrounded by a ring of smaller warts and granules, which give a reticulated appearence to weathered specimens; endoperidium bay-brown, membranous, dehiscing by a small stoma situated at the apex of a definite umbo (which is frequently wanting); sterile base occupying the stem-like base, prominent, cells large, ferruginous, often tinged with purple; diaphragm absent.

Gleba yellowish, becoming olivaceous; columella prominent, elliptical; capillitium threads deep chestnut brown, sparsely branched or simple, continuous, not pitted. Spores globose, 3.5-4 mmm. diam., apedicellate; epispore pallid olivaceous, finely and closely verrucose.

Habitat: Solitary, in groups or caespitose on the ground, usually in vegetable debris on the forest floor.

Distribution: Britain; Europe; North and South America; India; East and South Africa; Algeria; Australia; New Zealand.

Weraroa, Wellington, Jan., 1920, *G.H.C.*
Raurimu, Jan., 1920, *E. H. Atkinson!*
Whakatikei, Wellington, June, 1923, *J. C. Neill!*
Orepuki, Southland, Nov., 1924, *J. C. Neill!*

The peculiar pointed verrucae of the exoperidium, which fall away and leave the endoperidium reticulate on account of the persistent smaller warts and granules, is the chief character of this species. It closely resembles *L. piriforme*, but is separated by this character, and by the more strongly warted spores; the sterile base, too, is usually more deeply coloured than that of *L. piriforme*.

5. **Lycoperdon spadiceum** Persoon, *Jour. Bot.*, vol. 2, p. 20, 1809 (Fig. 18.)

L. Cookei Mass., *Jour. Roy. Micr. Soc.*, p. 714, 1887.

Peridium up to 25 mm. diam., subglobose or more commonly shortly pyriform, with a long and slender rooting base, which may sometimes be branched; exoperidium furfuraceous, often in the form of mealy squamules; endoperidium umber brown, papyraceous, smooth, dull, flaccid, sometimes covered with lime granules, dehiscing by an apical, torn, plane stoma; sterile base scanty, occupying the lower third of the peridium, of minute cells, umber brown; diaphragm absent.

Gleba olivaceous, becoming umber; columella absent; capillitium threads olivaceous, freely branched, continuous, about the diameter of the spores, not pitted. Spores globose, apiculate, 4-4.5 mmm. diam.; epispore olivaceous, minutely but distinctly verruculose.

Habitat: Solitary or in small groups on the ground.

Distribution: Britain; Europe; Australia; New Zealand.

Ashburton, Canterbury, Aug., 1925, *J. C. Neill!*

Kelburn, Wellington, July, 1925, *G.H.C.*

The plant may be recognised by the small size, pyriform shape, long rooting base and small-celled sterile base. The capillitium is freely branched, the plant differing in this respect from the European form; but in all other particulars it appears to be similar, even to the incrustation of lime granules on the peridium of occasional plants.

The cellular base separates it from *L. pusillum*, which it resembles in size, colour and nature of the gleba; and from small forms of *L. polymorphum*, that of the latter plant being compact.

6. **Lycoperdon polymorphum** Vittadini, *Mon. Lyc.*, p. 39, 1842. (Fig. 12.)

L. furfuraceum Schaeff. ex de Toni, in Sacc. *Syll. Fung.*, vol. 7, p. 110, 1888.

L. cepaeforme (Bull.) Mass., *Jour. Roy. Micr .Soc.*, p. 722, 1887.

L. hungaricum Hollos, *Mathem. Term.*, vol. 19, p. 1, 1901.

L. nigrum Lloyd, *Lyc. Aus.*, p. 30, 1905.

Peridium up to 6 cm. diam., yellow, becoming brown, depressed-globose, or more frequently pyriform, with or without a stem-like base; exoperidium of minute spines or verrucae, often furfuraceous, fugacious, endoperidium membranous, often smooth and polished, dehiscing by a small, torn, plane apical stoma; sterile base compact, of the same nature as the gleba, concolorous, frequently scanty; diaphragm absent.

Gleba yellowish, becoming olivaceous; columella absent; capillitium threads pallid olive, thin walled, freely branched, continuous, about the diameter of the spores, pitted. Spores globose, 4.5-5.5 mmm. diam., apiculate; epispore tinted, closely and finely verruculose.

Habitat: Solitary or in small groups on the ground.

Distribution: Britain; Europe; North America; Algeria; South Africa; Australia; New Zealand.

Weraroa, Wellington, Oct., 1919, *E. H. Atkinson!*

The species is characterized by the nature of the sterile base, which is compact and composed of intricately interwoven hyphae of a similar type to that of the tissues of the gleba. Frequently the sterile base is scantily developed, when plants approach *L. pusillum;* to this form the name *L. cepaeforme* has been applied, but it is not possible to maintain this as a species, for in the same collection may be present plants with either scanty or well-developed sterile bases.

7. **Lycoperdon pusillum** Persoon, *Jour. Bot.*, vol. 2, p. 17, 1809. (Fig. 13.)

Bovista pusilla Pers., *Syn. Meth. Fung.*, p. 138, 1801.

Lycoperdon pusillum (Batsch) Fries, *Syst Myc.*, vol. 3, p. 33, 1829.

L. dermoxanthum Vitt., *Mon Lyc.*, p. 34, 1842.

L. microspermum Berk., in Hook. *Jour. Bot.*, vol. 6. p. 172, 1854.

L. mundulum Kalchbr., *Grev.*, vol. 9, p. 3, 1880.

Bovista pusilla (Fr.) de Toni; Mass., *Jour. Roy. Micr Soc.*, p. 722, 1887.

B. dermoxanthum (Vitt.) de Toni ,in Sacc. *Syll. Fung.*, vol. 7, p. 100, 1888.

B. mundula (Kalchbr.) de Toni, *l.c.*, p. 98.

Lycoperdon pseudopusillum Hollos, *Noev. Koezl.*, vol. 2, p. 75, 1903.

L. semi-immersum Lloyd, *Myc. Notes*, p. 1306, 1924.

Peridium up to 20 mm. diam., globose or sub-globose, yellowish. becoming brown, with a prominent basal rooting strand; exoperidium covered with minute fugacious mealy squamules or flattened verrucae; endoperidium membranous, smooth, shining, flaccid, dehiscing by a small, irregular, plane, apical stoma; sterile base absent.

Gleba yellowish, becoming brown; columella absent; capillitium threads olive, continuous, freely branched, pitted. Spores globose, 3.5-5 mmm. diam., apiculate; epispore olive, finely and distinctly verruculose.

Habitat: Solitary or in small groups on the ground, often in cultivated fields.

Distribution: Britain; Europe; North America; China; East and South Africa; Ceylon; Australia; New Zealand.

Ashburton, Canterbury, Jan., May, 1925, *J. C. Neill!*

Roxburgh, Otago, May, 1925, *J. C. Neill!*

This is a small plant with a sub-globose peridium, and small but strongly developed rooting base. It is characterized by the absence of a sterile base, the freely branched, pitted capillitium, and flaccid, shining peridium.

8. **Lycoperdon glabrescens** Berkeley, *Fl. Tas.*, vol. 2, p. 226, 1860. (Fig. 14.)

Bovistella glabrescens (Berk.) Lloyd, Lyc. Aus., p. 28, 1905.
B. australiana Lloyd, *l.c.*
B. rosea Lloyd, *Myc. Notes*, p. 248, 1906.

Peridium up to 5 cm. diam., depressed globose or sub-globose, often pyriform, tapering into a small but well-developed stem-like base; exoperidium of small warts, larger towards the apex, fugacious; endoperidium bay brown, smooth, membranous, dehiscing by a small, erumpent, torn, apical stoma; sterile base well developed, cells small, often tinged with purple; diaphragm absent.

Gleba dark olivaceous, often with a purple cast; columella wanting; capillitium threads freely branched, deeply coloured, about the diameter of the spores, continuous, pitted. Spores globose, 4-5 mmm. diam., pedicels tinted, acuminate, up to 15 mmm. long; epispore olivaceous, minutely verruculose.

Habitat: In groups on the ground, usually in pastures.
Distribution: Australia; New Zealand.
Queenstown, Otago, May, 1922, *J. B. Cleland!*
Ashburton, Canterbury, Aug., 1925, *J. C. Neill!*

This and the following species possess long, persistent pedicels attached to the spores; these structures are usually 12-15 mmm. in length, tinted and acuminate. Species with this character are readily segregated into a pedicellate section. As has been shown, Lloyd places these two species in *Bovistella*, but as both possess the capillitium of the *Lycoperdon* type, the writer believes they should be retained in the latter genus.

Lloyd has named this species *Bovistella australiana*, but as the species is well covered by the description of *L. glabrescens*, his specific name *australiana* is considered superfluous.

The species is separated from the following solely by the nature of the exoperidium, which consists of fine fugacious warts and granules, not of cruciate spines; they are closely related, however, so much so that it would not be possible to separate forms of either species from which the exoperidium had disappeared.

9. **Lycoperdon scabrum** (Lloyd) n. comb. (Figs. 16, 17.)

Bovistella scabra Lloyd, *Myc. Notes, p.* 282, 1906.
B. nigrica Lloyd, *Myc Notes*, p. 1115, 1922.

Peridium up to 3 cm. diam., depressed globose or pyriform, umber, with a well-developed rooting base; exoperidium of long black or brown spines, 1-3 mm. long, free at base, frequently connivent at apices, fugacious; endoperidium umber, at length smooth, shining, membranous, dehiscing by an apical, erumpent, torn, toothed stoma; sterile base occupying the lower third of the peridium, of small cells, concolorous; diaphragm absent.

Gleba olivaceous, becoming umber; columella absent; capillitium threads olivaceous, freely branched, pitted, continuous. Spores globose, 4-5 mmm. diam., pedicels up to 15 mmm. long, tinted, acuminate; epispore olive, finely and evenly verruculose.

Habitat: Solitary or in small groups on sandy ground.
Distribution: Australia; New Zealand.
Weraroa, Wellington, Oct., 1919, *E. H. Atkinson!*
Levin, Wellington, Nov., 1919, *G.H.C.* Type collection of *Bovistella nigrica* Lloyd.

Characterized by the long connivent spines of the exoperidium. *Bovistella nigrica* is identical in all particulars save that of colour, but the colour is not constant, for in one collection are both bay brown and umber brown specimens.

Doubtful and Excluded Species.

The following have been recorded in literature as having been collected in New Zealand. Most of the records are in Massee's Monograph (1887), in which he appears to have described as new every specimen in the Kew herbarium which was not placed in the cover of some well-known European species. His so-called species have been compiled in Cooke's Handbook (1892), but apparently no attempt has been made to ascertain their validity.

a. *L. Colensoi* Cke. et Mass. = *L. perlatum* Pers.
b. *L. Fontanesii* Dur. et Mont = *Calvatia caelata* (Bull.) Morg.
c. *L. microspermum* Berk. = *L. pusillum* Pers.
d. *L. novae-zelandiae* Lev. = *Calvatia lilacina* (B. et M.) Lloyd.
e. *L. reticulatum* Berk. in Herb.; Mass. This is probably a synonym of *L. pusillum* Pers. or *L. perlatum* Pers., but the description is too poor to allow of its being placed with any degree of certainty.
f. *L. Sinclairii* Berk. = *Calvatia lilacina* (B. et M.) Lloyd.

(3) **Bovistella** Morgan, *Jour, Cin. Soc. Nat. Hist.*, vol. 14, p. 145, 1892.

Peridium globose or pyriform, with a well-developed rooting base; of two layers, an external, thin, usually fugacious exoperidium; and an inner, flaccid, membranous endoperidium which dehisces by an apical, definite stoma; sterile base present or absent; diaphragm absent.

Gleba of capillitium and spores; columella absent; capillitium threads free, each consisting of a thick main stem and numerous dichotomous tapering, acuminate branches. Spores coloured, continuous, rough or smooth, globose or elliptical, pedicellate or not.

Habitat: Solitary or in small groups on the ground; remaining attached at maturity to the place of origin; epigaean.
Distribution: Britain; Europe; North America; India; Australia; New Zealand.

Morgan's conception of the genus, based on a single species, was a *Bovista* with a sterile base. In his earlier paper Lloyd (1905, *a*) claimed the presence of a sterile base was not a good character on which to separate *Bovistella* from *Bovista* (basing his argument on

the fact that its absence has not been considered of sufficient importance to separate the proposed genus *Globaria* Quel. from *Lycoperdon*), and proposed to separate the two upon habit, *Bovista* being a genus in which plants break away at maturity from the point of attachment, *Bovistella* persisting as does *Lycoperdon*. And it will be seen that this is the only character upon which separation of the two genera is possible. In a later paper Lloyd (1906) further emended the genus to include all plants possessing a rooting base together with either pedicellate spores or capillitium of the *Bovista* type, or both. This would necessitate the removal of many species from *Lycoperdon*, possessing the *Lycoperdon* type of capillitium but differing in the possession of pedicellate spores.

The writer cannot agree with Lloyd in this treatment of the genus, as several genera of the Lycoperdeae are separated upon the structure and nature of the capillitium, and to thus arbitarily destroy this method of differentiation does not aid the systematist. Had he erected a separate genus, or a separate section, for those species of *Lycoperdon* possessing pedicellate spores and *Lycoperdon* capillitium, no complaint could be lodged, but his present stand is untenable.

Many species of *Lycoperdon* possess a freely branched capillitium, which superficially resembles that of *Bovistella* (as for example, *L. pusillum, L. spadiceum, L. polymorphum*); but as the threads of *Bovistella* may be readily removed intact, mounted and photographed (Fig. 19) it is evident the resemblance is merely superficial, and should not lead to confusion.

The genus contains about six species, only one of which is known to occur in New Zealnad.

1. **Bovistella bovistoides** (Cke. et Mass.) Lloyd, *Myc. Notes*, p. 247, 1906.

Mycenastrum bovistoides Cke. et Mass., *Grev.*, vol. 16, p. 26, 1888.

Scleroderma bovistoides (C. et M.) de Toni, in Sacc. *Syll. Fung.*, vol. 7, p. 489, 1888.

Peridium globose, depressed globose or shortly pyriform, up to 2 cm. diam., with a strong rooting base; exoperidium thin, white, sometimes persisting as small areolate areas, but usually falling away completely; endoperidium flaccid, dull, bay brown, darker basally, stoma apical, slightly erumpent and toothed, or plane; sterile base absent.

Gleba olivaceous, becoming umber; capillitium threads scantily branched, thin walled, pitted, pallid chestnut brown. Spores globose, seldom obovate, 4-6 mmm. diam., pedicels tinted, attenuate, up to 15 mmm. long; epispore chestnut brown, closely and finely verruculose.

Habitat: Solitary or in small groups on the ground.

Distribution: Australia; New Zealand.

Lake Te Anau, Otago, Jan., 1920, *E. H. Atkinson!*

The rooting base separates the species from *Bovista brunnea*, which otherwise it resembles closely. As this structure may be absent from old and weathered specimens it then becomes difficult to place old specimens. In such cases the capillitium serves as the only character by which separation can be made, being more scantily branched and lighter in colour than that of *Bovista brunnea*.

EXCLUDED SPECIES.

a. Bovistella australiana Lloyd = *Lycoperdon glabrescens* Berk.

b. Bovistella cuprica Lloyd, *Letter No. 60*, p. 9, 1915.
This the writer believes to be a *Lycoperdon,* but the description is so poor as to make the placing in any genus uncertain.

c. Bovistella nigrica Lloyd = *Lycoperdon scabrum* (Lloyd) G. H. Cunn.

d. Bovistella scabra Lloyd = *Lycoperdon scabrum* (Lloyd) G. H. Cunn.

(4) **Bovista** Dillenius ex Persoon, *Syn. Meth. Fung.*, p. 136, 1801.

Peridium globose, subglobose or shortly pyriform; of an outer fugacious, thin and fragile exoperidium; and an inner membranous, tough, firm endoperidium; dehiscing by a single apical stoma; sterile base absent.

Gleba of capillitium and spores; columella absent; capillitium threads free, each consisting of a thick stem and numerous dichotomous, tapering, acuminate branches. Spores coloured, continuous, rough or smooth, globose, obovate or elliptical, pedicellate.

Habitat: Solitary or in small groups on the ground; breaking away from the point of attachment at maturity; epigaean.

Distribution: Europe; North and South America; Australia; New Zealand.

The name *Bovista* was used by Persoon as a generic name for all plants of the genera *Bovista, Bovistella, Calvatia, Disciseda* and *Lycoperdon* devoid of a sterile base. This classification was followed by all workers until Morgan (1892) published an emended description of the genus, limiting it to plants with the characteristic capillitium described above, and devoid of a sterile base. As has been shown, the absence of a sterile base is not of generic value, so the writer would follow Lloyd (1905, *a*) in limiting the genus to plants with the *Bovista* capillitium and habit of breaking away from the point of attachment at maturity.

The walls of the capillitium threads are generally perforated with conic pits (absent from *B. purpurea*); but the pits are also present in certain species of *Bovistella* and *Lycoperdon,* so cannot be considered of generic import.

About 8 species are known, but only two are known to occur in New Zealand, one being endemic.

1. **Bovista brunnea** Berkeley, *Fl. N.Z.*, vol. 2, p. 119, 1855. (Fig. 15.)

Peridium depressed globose, up to 3 cm. diam., with a minute rooting base which usually breaks away at maturity; exoperidium white, furfuraceous, evanescent, often areolate; endoperidium chestnut-brown or pallid umber, firm, smooth, shining, often marked with fine areolate lines, stoma irregular, indefinite, slightly erumpent, toothed or entire, frequently plane.

Gleba pallid ferruginous or olivaceous; capillitium freely branched, walls thick, pitted, dark chestnut brown. Spores globose or obovate, 3.5-5 mmm. diam., pedicels tinted or hyaline, acuminate,

up to 14 mmm. long; epispore pallid ferruginous, closely and finely verruculose.

Habitat: Solitary on the ground.

Distribution: Australia; New Zealand.

Lake Te Anau, Otago, Jan., 1920, *E. H. Atkinson!*
Tapanui, Otago, Mar., 1922, *G. H. C.*
Peninsula, Otago, July, 1922, *Miss H. K. Dalrymple!*
Methven, Canterbury, Feb., 1925, *J. C. Neill!*
Lewis River, Caterbury, Feb., 1926, *G. H. C.*
Maruia River, Westland, Feb., 1926, *G.H.C.*

Characterized by the firm, brown, smooth and shining endoperidium, and freely branched, dark coloured, thick-walled capillitium threads. It closely resembles *Bovistella bovistoides* (see the note under this species), so much so that until he collected abundant specimens in the valleys of the Lewis and Maruia rivers, the writer was in doubt as to which species certain collections previously made should be referred, and in a previous paper (1925) placed several collections under *Bovistella bovistoides.*

2. **Bovista purpurea** Lloyd, *Myc. Notes,* p. 1201, 1923. (Figs. 19, 20.)

Peridium globose or depressed globose, up to 2.5 cm. diam.; with a small, pulvinate rooting base; exoperidium thin, dingy white or bay brown, falling away in irregular flakes, but partly persisting towards the base; endoperidium usually lead coloured, often purple, smooth, firm, shining, dehiscing by an irregularly torn, circular or elliptical, crumpent, toothed stoma.

Gleba purple brown; capillitium threads stout, freely branched, not pitted. Spores obovate or globose, 5-6 mmm. diam., pedicels hyaline, acuminate, up to 12 mmm. long; epispore chestnut brown, verruculose.

Habitat: Solitary on the ground.

Distribution: New Zealand.

Mapua, Nelson, May, 1922, *G.H.C.* Type collection.
Ashburton, Canterbury, Jan., 1925, *J. C. Neill!*
Blenheim, Marlborough, May, 1925, *J. C. Neill!*

The species is characterized by the dark colour, flaking, partly persistent exoperidium, and stout, freely branched, non-pitted capillitium threads.

DOUBTFUL SPECIES.

Bovista ovalispora Cke. et Mass., *Grev.,* vol. 16, p. 33, 1887.

This species, described from New Zealand material forwarded to Kew, is said to possess oval spores, 6x 4.5 mmm. Whether it is a valid species the writer is unable to judge from the description; but it is significant that the spores of *Bovista brunnea* and *B. purpurea* are frequently obovate.

(5) **Disciseda** Czernaiaiev, *Act Mosc.,* vol. 2, p. 153, 1845.
Catastoma Morgan, *Jour. Cin. Soc. Nat. Hist.,* vol. 14, p. 142, 1892.

Peridium depressed globose; of an outer exoperidium which may be thick or thin, membranous, or compact and formed of hyphae im-

mixed with sand or vegetable debris, fragile, breaking away irregularly save a small discoid basal portion; endoperidium papyraceous or membranous, tough, variously coloured, smooth or furfuraceous, dehiscing by a definite apical or basal stoma; sterile base absent.

Gleba of spores and capillitium, pulverulent at maturity; capillitium threads short, simple, occasionally short-branched, smooth, usually continuous, hyaline or coloured. Spores pedicellate or not, globose or elliptical, continuous, rough or smooth, coloured.

Habitat: Solitary, in small groups or caespitose on or in the ground; epigaean or hypogaean.

Distribution: Europe; Asia; Africa; North and South America; Australia; New Zealand.

Species of this genus were included under *Bovista* until Morgan (1892) showed the genus was separated by the nature of the capillitium, this consisting of simple fragments of hyphae, differing in this particular from *Bovista* (which has capillitium threads of a complex nature) and *Lycoperdon*, in which the threads are of a similar type but not fragmented.

In the species on which he based the genus *Catastoma,* Morgan stated that the stoma was at the base of the plant, and made this one of the chief characters of the genus. But since this period many species have been found with the stoma apical, so that this cannot be considered of generic import. It has been suggested that a separate genus should be erected to contain those species with the latter character, but this is impracticable, for with most species now placed in the genus it is not known whether the stoma is apical or basal.

On the appearance of Morgan's paper, Hollos (1903) was able to recognize the fact that the genus *Catastoma* was the same as the one erected 45 years previously by Czernaiaiev, so the name *Disciseda* must replace *Catastoma.* Lloyd has taken exception to this and throughout his publications uses the generic name *Catastoma,* a name which is untenable according to the rules of priority.

In most species the exoperidium is in the nature of a membrane composed partly of hyphae, partly of attached debris; in some it is distinctly membranous, yet even with species possessing this latter condition the former may be present.

About eight species are known, only two of which are found in New Zealand.

Key to the Species.

Spores 3-5 mmm. almost smooth ..	..	1. *D. candida*
Spores 8-10 mmm., strongly verrucose	..	2. *D. verrucosa.*

1. **Disciseda candida** (Schw.) Lloyd, *Myc. Notes,* p. 100, 1902. (Fig. 23.)

Bovista candida Schw., *Fung. Carol.,* no 333, 1822.
B. circumscissa Berk. et Curt., *Grev.,* vol. 2, p. 50, 1874.
Catastoma circumscissa (B. et C.) Morgan, *Jour. Cin. Soc. Nat. Hist.,* vol. 14, p. 143, 1892.
Disciseda circumscissa (B. et C.) Hollos, *Term. Fuez.,* vol. 25, p. 102, 1902.

Peridium up to 3 cm. diam., depressed globose; exoperidium thick, firm, of hyphae and vegetable debris immixed, breaking away irregularly, save the cupulate basal portion; endoperidium ferruginous or umber, membranous, tough, covered in part by a gelatinous, reticulate layer (which may be wanting), dehiscing by a fimbriate, mammose stoma.

Gleba olivaceous, umber, or tinged with purple, pulverulent; threads of the usual type. Spores globose, 3.5-5 mmm. diam., apiculate; epispore pallid chestnut brown, very finely verruculose.

Habitat: Solitary or in small groups in grassy areas; hypogaean.
Distribution: North America; Europe; South America; Australia; New Zealand.
Roxburgh, Otago, Aug., 1925, *J. C. Neill, D. W. McKenzie!*
Waikare, Canterbury, Jan., 1926, *G.H.C.*

Characterized by the small, almost smooth spores, fimbriate stoma, and gelatinous layer lying between the exoperidium and endoperidium. According to Morgan the stoma is situated at the base of the plant.

The gleba is olivaceous when young, deep umber when mature; frequently in Australian and New Zealand specimens, identical in all other respects, it is tinted purple. It might be suggested that the latter plants belong to a different species, but to separate a species on such a flimsy character seems to the writer to be absurd, especially as the colour is known to vary in other species. For example in the Australian *D. hyalotrix,* the colour may be purple or olivaceous.

2. **Disciseda verrucosa** n. sp. (Fig. 24.)

Peridium up to 3cm. diam., depressed globose; exoperidium brown, tough, consisting of hyphae and debris immixed, flaking away irregularly save a small persistent basal portion; endoperidium thick, tough, membranous, bay brown or purplish, dehiscing by an irregularly torn, toothed apical stoma.

Gleba purplish, pulverulent; capillitium threads tinted, usual type. Spores globose, 9-10.5 mmm. diam., apedicellate; epispore chestnut brown, covered with coarse, round-topped pallid verrucae.

Habitat: Solitary on the ground; hypogaean.
Distribution: Australia; New Zealand.
Milford Track, Otago, Jan., 1920, *E. H. Atkinson!* Type collection.

Characterized by the large, coarsely verrucose spores, indefinite toothed stoma and purplish gleba. The species would appear to be not uncommon in Australia, for four collections are in the possession of Dr. J. B. Cleland, Adelaide.

DOUBTFUL SPECIES.

Lloyd records *D. hypogaea* as being collected in Canterbury. The writer has seen no specimens from New Zealand.

Lloyd (1917) also describes a species under the name of *Catastoma magnum,* stated to have been collected in Canterbury. He considers

it differs from *D. anomala* in the larger size, thick, leathery exoperidium, and in the apedicellate, strongly roughened spores, but claims it is but a form of *D. anomala*. From his description it is impossible to say to what species it should be referred. The same "species" is recorded from South Africa by Verwoerd (1925).

(6) **Abstoma** n. gen.

Peridium subglobose, of two layers; a thick, fragile, exoperidium composed of hyphae immixed with sand particles, breaking away irregularly; and a papyraceous, fragile, coloured endoperidium which dehisces by irregular rupture, a stoma being absent.

Gleba of spores and capillitium, firm at maturity; capillitium threads short, occasionally branched, smooth, continuous, coloured. Spores apedicellate, globose, rough, coloured.

Habitat: Solitary or in small groups on the ground; hypogaean.
Distribution: New Zealand.

Abstoma is separated from *Disciseda* because of the absence of a stoma, dehiscence being effected by the irregular breaking away of both exoperidium and endoperidium. The genus is known from the following endemic species.

1. **Abstoma purpureum** (Lloyd) n. comb. (Figs. 21, 22.)

Catastoma purpurea Lloyd, *Myc. Notes*, p. 1120, 1922.

Peridium up to 4 cm. diam., subglobose or depressed globose; exoperidium a sand case, up to 3 mm. thick, firm, brittle, dull purple, breaking away irregularly and completely; endoperidium thin, papyraceous, fragile, dark purple, almost black, free from the endoperidium save at the base, where attached, but not organically, dehiscing by irregular rupture.

Gleba purple, firm; capillitium threads deep chestnut brown, short, thick-walled. Spores globose or shortly elliptical, 10-14.5 mmm. diam., apedicellate; epispore deep chestnut brown, closely and finely reticulate.

Habitat: In sand among sand-dunes; hypogaean.
Distribution: New Zealand.

Weraroa, Wellington, Nov., 1919, *E. H. Atkinson, S. A. Cunningham, G.H.C.* Type collections.

The species is characterized by the purple colour of the whole plant, the thick sand-case exoperidium, fragile, non-stomate endoperidium and deeply coloured, reticulate spores.

The habit is peculiar. The plant grows buried to a depth of several centimetres, 7-10 or more, in sand at Weraroa beach. When wind erosion occurs, as is frequent in this area of shifting dunes, the sand is blown for some distance, large amphitheatres being formed, and the globose plants are carried by the wind often to one kilometre or more from their place of origin. They are rolled along the ground and finally arrested by debris of the nature of branches of trees and stumps half buried at the tops of the long dune slopes. Here they come to rest, and the peridium is gradually removed by friction of sand-particles.

(7) **Mycenastrum** Desvaux, *Ann. Sci. Nat.*, ser. 2, vol. 17, p. 143, 1842.

Peridium globose or subglobose, of two layers; a thin, floccose, fugacious exoperidium; and a thick, indurated, persistent endoperidium, dehiscing in a stellate manner, or by the irregular rupture of the apical portion; sterile base absent.

Gleba olivaceous, becoming umber, pulverulent; capillitium threads very abundant, of numerous short hyphae, continuous, short-branched, branches beset with stout, spinous processes. Spores subglobose, coloured, coarsely echinulate.

Habitat: Solitary, in small groups or caespitose on the ground; epigaean.
Distribution: Europe; North America; Asia; India; Africa; Australia; New Zealand.

The genus contains a single species, and is characterized by the nature of the capillitium, the hard and coriaceous endoperidium and the method of dehiscence.

1. **Mycenastrum corium** (Guersent) Desvaux, *l.c.*, p. 147. (Figs. 25, 26.)

Lycoperdon corium Guersent, in DC., *Fl. Fr.*, suppl. 2, p. 598, 1815.
Scleroderma corium Grav., in Duby, *Bot. Gall.*, vol. 2, p. 892, 1830.
Mycenastrum phaeotrichum Berk., in Hook. *Jour. Bot.*, vol. 2, p. 418, 1843.
M. spinulosum Peck, *Thirty-third Rept.*, for 1879, p. 15, 1883.
M. olivaceum Cke. et Mass., *Grev.*, vol. 16, p. 33, 1887.
Scleroderma olivaceum (C. et M.) de Toni, in Sacc. *Syll. Fung.*, vol. 7, p. 139, 1888. *S. phaeotrichum* (Berk.) de Toni, *l.c.*

Peridium globose, subglobose or pyriform, up to 20 cm. or more in diam.; exoperidium tomentose, fugacious, greyish; endoperidium thick, 2-5 mm., smooth, polished, at first greyish, becoming bay brown, dehiscing in a stellate manner, or by the irregular falling away of the upper portion.

Gleba olivaceous, becoming umber; capillitium threads of the usual type. Spores subglobose, 11-13 mmm. diam., apedicellate; epispore chestnut brown, densely echinulate, wall 2 mmm. thick.

Habitat: Solitary, in groups or caespitose on the ground.
Distribution: Same as that of the genus.
Castlepoint, Wairarapa, Jan., 1923, *Miss Edwin!*
Spring Creek, Blenheim, Jan., 1925, *W. D. Reid!*

The species varies greatly in the size of the peridium, degree of spininess and branching of the capillitium, roughness of the spores, and colour of the gleba. If plants are collected and dried when young the gleba appears olivaceous; if dried when mature it is umber or even purple. On the former condition was based *M. olivaceum;*

on the latter *M. phaeotrichum*. Caespitose plants are frequent, at least in Australia and New Zealand.

(8) **Geaster** Micheli ex Fries, *Syst. Myc.*, vol. 3, p. 9, 1829.

Geastrum Pers., p.p., *Syn. Meth. Fung.*, p. 130, 1801.
Cycloderma Klotzsch, *Linnaea*, vol. 7, p. 203, 1832.

Peridium globose or acuminate; exoperidium of three layers, an external mycelial layer, a middle fibrillose layer, and an internal fleshy layer; at first closely investing the endoperidium, but distinct, splitting at maturity from the apex downwards into several stellate rays which may be revolute or involute; endoperidium pedicellate or sessile, membranous or papyraceous, thin, glabrous or roughened; dehiscing by a single apical stoma which may be peristomate or naked. Gleba of capillitium and spores; columella present or absent; capillitium threads simple, long, apically accuminate, arising from the columella or inner wall of the endoperidium, coloured. Spores globose or subglobose, continuous, coloured, rough or smooth.

Habitat: Solitary, in groups, or caespitose on the ground or vegetable debris in open pastures, under hedgerows or on the forest floor; epigaean or hypogaean.

Distribution: World-wide.

In this genus are included about 30 species, of which 23 are found in Australasia, and 7 in New Zealand. No endemic species are known.

The mature plant consists of two well-defined groups of tissues—the exoperidium and the endoperidium.

Exoperidium.

In the mature plant this splits from the apex downwards into 5-14 or more variable rays. These may be expanded, revolute or involute; those plants with rays which are involute when dry (or during dry weather) are said to be hygroscopic; those with rays which remain expanded (or revolute) are said to be non-hygroscopic.

The exoperidium consists of three well-defined tissues:—

The mycelial or outer layer;
The fibrillose or middle layer; and
The fleshy or inner layer.

Mycelial layer. This is well seen in unexpanded plants. If these are epigaean the exterior is either felted-tomentose (*G. velutinus*) or comparatively smooth (*G. triplex*). In the former case the layer is composed of stout, persistent hyphae arranged in a palisade 1-2 mm. thick; in the latter the layer is thin, more or less evanescent and composed of thin-walled hyphae.

If plants are hypogaean the mycelial layer consists of long hyphae arising from all parts of the plant and ramifying for some distance into the substratum; consequently when such plants expand, this layer either holds the exoperidium permanently to the substratum, or, as more frequently happens, is torn away from the substratum, the mycelial layer then holding firmly to the exterior of the exoperidium quantities of vegetable debris. Thus the habit of freshly

gathered plants may be told at a glance, those which are epigaean possessing an exterior free or almost free from debris, those which are hypogaean having the exterior wholly or partially covered with debris. Even in herbarium specimens the habit as a rule may be determined by the presence or absence of debris.

Fibrillose layer. This tissue consists of intricately woven hyphae of two kinds, arranged with their long axes predominantly radial. The portion next the fleshy layer is strengthened by numerous thick-walled hyphae similar to those of the capillitium. At the base this layer is attached to the endoperidium and the columella and pedicel if present. The whole tissue is tough and membranous, and in old and weathered plants may be the only remaining tissue of the exoperidium.

Fleshy layer. This in freshly expanded plants is soft, thick and flesh coloured; after exposure it shrinks considerably, changes to some shade of brown, and frequently becomes rimose. It occasionally flakes away in irregular patches, and sometimes may peel from the fibrillose layer and assume a cupulate appearance around the base of the exoperidium. This tissue is definitely pseudoparenchymatous.

ENDOPERIDIUM.

This structure encloses the gleba, consisting of capillitium and spores. It is attached basally to the base of the exoperidium, and is perforated apically by a solitary stoma, through which at maturity the spores escape. In texture it is membranous or papyraceous, consisting of partly gelatinized hyphae. The exterior is usually glabrous, but may be farinose (*G. pectinatus, G. limbatus*), tomentose (*G. triplex*), or covered with roughened particles (*G. minus*). The colour ranges from dingy white to dark umber.

The endoperidium may be pedicellate, being attached by its base to the exoperidium by a pedicel of varying length and thickness, or sessile (the common condition with saccate plants) when it is attached by a broad base and partly enclosed within the saccate base of the exoperidium.

The apical stoma may be a poorly defined aperture scarcely discernible from the endoperidium—when the species is said to possess a naked, indefinite mouth; or the stoma may be enclosed within a definite peristome, when the species is said to possess a definite, peristomate mouth. Should the peristome be regularly pleated or fluted it is said to be plicate; if silky and made up of innumerable parallel fibrils arranged radially around the stoma it is said to be fibrillose.

Gleba. This embraces all tissues enclosed within the endoperidium. The capillitium threads consist of innumerable fusiform or cylindrical, coloured, continuous, sparsely branched hyphae. They arise from the columella and less abundantly from the inner surface of the endoperidium.

The spores are globose or sub-globose, usually some shade of brown, and possess verrucose or verrucose-echinulate epispores. Their size and epispore markings are useful diagnostic characters.

The columella arises from the base of the exoperidium (fibrillose layer) and is a continuation of the pedicel, when present. It is

usually cylindrical, but may be clavate or globose. It is often wanting in the mature plant (being used in the production of the threads of the capillitium) but may be readily seen when unexpanded plants are sectioned.

All the New Zealand species, with two exceptions (*G. triplex* and *G. velutinus*) are hypogaean, developing underground and appearing on the surface only at dehiscence.

KEY TO SPECIES.

Mouth peristomate.	
Peristome sulcate.	
Base of the endoperidium smooth or striate	**1. *G. pectinatus***
Base of the endoperidium plicate	**2. *G. plicatus***
Peristome fibrillose.	
Endoperidium pedicellate.	
Plants minute, 1-3 cm.	**3. *G. minus***
Plants large, 4-8 cm.	**4. *G. limbatus***
Endoperidium sessile.	
Exoperidium externally tomentose	**5. *G. velutinus***
Exoperidium externally smooth	**6. *G. triplex***
Mouth naked and indefinite	**7. *G. floriformis***

1. **Geaster pectinatus** (Persoon) Lloyd, *Geastreae*, p. 15, 1902. (Fig. 27.)

Geastrum pectinatum Pers., *Syn. Meth. Fung.*, p. 132, 1801.
Geaster striatus Fr., p.p., *Syst. Myc.*, vol. 3, p. 13, 1829.
G. Schmidelii Vitt., *Mon. Lyc.*, p. 12, 1842.

Plants at first globose, submerged, becoming superficial and expanded when 3-5 cm. across. Exoperidium split to about the middle into 5-12 subequal, acute rays which are expanded or subrevolute; fleshy layer brown, usually flaking away in irregular patches, leaving exposed the ochraceous, fibrillose layer; exterior covered with debris held by the adnate mycelial layer, which is persistent but tends to flake away; base concave.

Endoperidium pedicellate, subglobose, depressed-globose or urceolate, 1-2 cm. diam., brown or lead coloured, often farinose, base tapering into pedicel, striate or not, apophysis present or absent; pedicel slender, 3-6 mm. long. Peristome sulcate, prominent, narrowly conical, concolorous.

Gleba ferruginous; columella inevident; capillitium threads tinted, fusiform, simple. Spores globose, 5.4-6.2 mmm.; epispore dark umber, moderately and coarsely verrucose, reticulate.

Habitat: Solitary or in groups on vegetable debris on the ground; hypogaean.

Distribution: Britain; Europe; North America; South Africa; Australia; New Zealand.

Dunedin, Otago, Aug., 1921, *Miss H. K. Dalrymple!*
Otaki Forks, Wellington, May, 1922, *E. H. Atkinson!*

Two other species, *G. plicatus* and *G. Bryantii* (latter not present in New Zealand) closely resemble *G. pectinatus* save in one or two minor characters. *G. plicatus* is separated solely by the plicate base of the endoperidium, *G. Bryantii* by the presence of a well-defined

collar around the base of the endoperidium immediately above the pedicel.

The endoperidium is often quite covered with a farinose substance which may be readily rubbed away. This covering is present also on other species, as for example *G. limbatus* and *G. minus*.

2. **Geaster plicatus** Berkeley, *Ann. Nat. Hist.*, vol. 3, p. 399, 1839. (Fig. 28.)

G. tenuipes Berk. *Fl. Tas.*, vol. 2, p. 264, 1860.
G. biplicatus Berk. et Curt., *Proc. Am. Acad. Arts & Sci.*, vol. 4, p. 124, 1860.

This subspecies is separated from the preceding solely on account of the plicate base of the endoperidium, for in all other respects it is practically the same.

Distribution: India; Bonin Is.; Ceylon; New Caledonia; South Africa; Australia; Tasmania; New Zealand.
Lake Papaetonga, Wellington, Aug., 1919, *G.H.C.*
Sandhills, Weraroa, Wellington, Nov., 1919 *E. H. Atkinson!*
Both collections determined as above by Lloyd.

3. **Geaster minus** (Persoon) n. comb. (Fig. 29.)

Geastrum quadrifidum var. *minus* Pers., *Syn. Meth. Fung.*, p. 133, 1801.
G. minimus Schw., *Syn. Fung. Carol.*, no. 327, 1822.
Geaster fornicatus Fr. p.p., *Syst. Myc.*, vol. 3, p. 12, 1829.
G. marginatus Vitt., *Mon Lyc.*, p. 19, 1842.
G. granulosus Fcl. *Enumerat.*, p. 41, 1860.
G. coronatus (Schaeff.) Schroet., p.p., *Krypt. Fl. Schw.*, vol 3, 1889; Lloyd, *Geastreae*, p. 31, 1902.
G. calceus Lloyd, *Myc. Notes*, p. 311, 1907.
G. juniperinus McBr., *Mycologia*, vol. 4, p. 85, 1912.

Plants at first globose, small, submerged, becoming erumpent and expanded when up to 3 cm. across. Exoperidium split to about the middle into 4-8 unequal, acuminate rays, which are commonly recurved or expanded, or may become fornicate by the mycelial layer splitting free from the fibrillose layer, which together with the fleshy layer becomes arched (fornicate) but remains attached by the apices of the rays to the mycelial layer, the latter remaining attached to the substratum; fleshy layer brown, rimose, frequently flaking away in patches.

Endoperidium pedicellate, 3-12 mm. diam., obovate, elliptical or depressed-globose, variable in size and shape, pallid white, tan, or bay brown, sometimes umber, glabrous, farinose or coated with closely adnate particles, giving to the whole a glistening appearance; pedicel up to 3 mm. long, frequently with an apical apophysis. Peristome variable, typically conical and fibrillose-fimbriate, frequently silky-fibrillose, sometimes almost plane and indefinite, seated on a definite silky area outlined by a depressed groove, or both silky area and groove may be wanting.

Gleba ferruginous; columella inevident. Spores globose, 4.5-5.8 mmm.; epispore fuscous or umber, finely, sparsely and irregularly verrucose.

Habitat: Solitary, in groups or caespitose on the ground.
Distribution: Europe; North America; South Africa; Jamaica; Ecuador; Australia; New Zealand.
Sandhills, Weraroa, Wellington, Nov., 1919, *S. A. Cunningham!*
Dunedin, Otago, May, 1922, *Miss H. K. Dalrymple!*
Ashburton, Canterbury, Aug., 1925, *J. C. Neill; D. W. McKenzie!*

This is a most variable species; specimens range in size from minute plants 5 mm. across to forms over 4 cm. across. The exoperidium may be revolute, fornicate (a form not yet collected in New Zealand), subhygroscopic or saccate. The endoperidium may be pedicellate (the usual condition) or almost sessile, and may be smooth, covered with numerous glistening particles, or with a thick white incrustation. The peristome may be plane, conical or obscure, and may be seated on a flattened silky zone outlined by a depressed groove, or this zone may be inevident and the groove wanting. The stoma may be fibrillose-silky, fimbriate-lacerate or almost indefinite. The spores, too, vary in the size and degree of roughness, and two types may be recognised, one averaging 5-5.8 mmm., the other 3.5-4.2 mmm.

Many names have been given these various forms, but it is not practicable to separate one from another owing to the difficulty of defining the limits of each.

The revolute and fornicate forms have been in the past considered as distinct species, the former being known as *G. minimus,* the latter as *G. coronatus,* but Coker (1924, p. 206) has shown that the fornicate form is but a condition of the other, for he found all connecting stages growing together.

4. **Geaster limbatus** Fries, *Syst. Myc.*, vol. 3, p. 15, 1829. (Figs. 30, 31, 32.)

Geastrum coronatus Pers., p.p., *Syn. Meth. Fung.*, p. 132, 1801.

Plants at first globose, submerged, becoming superficial and expanded when 4-8 cm. across. Exoperidium split to about the middle into 7-10 unequal, acute rays, which are expanded and revolute, or sometimes partially involute; fleshy layer brown or ferruginous, continuous or rimose, frequently farinose; exterior covered with debris held by the persistent, adnate mycelial layer, in old specimens partially flaking away; base concave or plane.

Endoperidium pedicellate; depressed-globose, obovate or subpyriform, globose when old, farinose when young, grey to umber, up to 1.5 cm. diam. Peristome depressed, acute, fibrillose, surrounded by a pallid or concolorous fibrillose or silky zone.

Gleba chocolate; columella almost obsolete. Spores globose, 4.9-5.4 mmm.; epispore fuscous, acutely, densely and coarsely warted.

Habitat: On the ground, usually in shade of trees or hedges.
Distribution: Britain; Europe, North America; East Africa; Australia; New Zealand.

Sandhills, Levin, Wellington, Oct., 1919, *E. H. Atkinson!*
Wadestown, Wellington, Apl., 1923, *J. C. Neill!*
Ashburton, Canterbury, Aug., 1925, *J. C. Neill; D. W. McKenzie!*
Kelburn, Wellington, Nov., 1925, *G.H.C.*

This species is separated from the preceding by the large size, well developed, stout pedicel and definitely fibrillose peristome. It is not uncommon throughout, growing in the shade of hedges or trees. One form has the endoperidium covered with numerous glistening particles, and on this account may be separated from the typical form. But this is of little specific value for this covering may be well developed or absent on different plants in the same collection.

5. **Geaster velutinus** Morgan, *Journ. Cin. Soc. Nat. Hist.*, vol. 18, p. 38, 1895. (Figs. 33, 34.)

? *G. javanicus* Lev., *Ann Sci. Nat.* ser. 3. vol. 5, p. 161, 1846.
? *G. dubius* Berk., *Jour. Linn. Soc.*, vol. 14, no. 130, 1875.
Cycloderma ohiensis Cke., *Grev.*, vol. 11, p. 95, 1883.
G. Lloydii Bres. et Pat., *Myc. Notes*, p. 50, 1901.

Plants ovate, bluntly pointed, superficial, attached to the substratum by a central basal cord, becoming expanded when 3-6 cm. or more across. Exoperidium saccate, split to about the middle into 5-8 expanded or revolute, broad, thick, subequal rays which when dry frequently split into two thin fibrous and persistent layers; fleshy layer flesh coloured, umber and rimose when dry; exterior free from debris, covered with close brown felted tomentum; base convex, marked with a prominent umbilical scar.

Endoperidium sessile, globose or depressed-globose, up to 2 cm. diam., brown or pallid tan, minutely furfuraceous or tomentose, lower portion enclosed by the saccate base of the exoperidium. Peristome small, broadly conical, fibrillose, seated on a depressed silky zone which may be wanting, concolorous or pallid.

Gleba umber; columella cylindrical; capillitium threads occasionally branched near their apices. Spores globose, 4-4.5 mmm.; epispore fuscous, finely and sparsely echinulate, reticulate.

Habitat: Crowded or in small groups on vegetable debris, frequently on decaying wood on the forest floor; epigaean.
Distribution: North America; Cuba; Porto Rico; Brazil; Gold Coast Colony; Africa; Australia; New Zealand.

Weraroa, Wellington, Aug., 1919, *G.H.C.;* May, 1923, *J. C. Neill!*
Botanical Gardens, Wellington, May, 1922, *J. B. Cleland!* July, 1925, *G.H.C.*

This is the most abundant species in New Zealand. It is separated from the following by the nature of the exterior of the exoperidium,

which is covered with a layer of close, felted tomentum; the latter possessing an almost smooth exterior. The epigaean habit is also characteristic of both species.

6. **Geaster triplex** Junghuhn, *Tijdschr.*, vol. 7, p. 287, 1840. (Figs. 35, 36.)

G. lageniformis Vitt., *Mon. Lyc.*, p. 16, 1842.
G. Archeri Berk., *Fl. Tas.*, vol. 2, p. 264, 1860.
G. Michelianus W. G. Sm., *Gard. Chron.*, p. 608, 1873.
G. vittatus Kalchbr., *Ung. Akad., d.d Wiss.*, vol. 17, p. 10, 1884.
G. coriaceus Col., *Trans. N.Z Inst.*, vol. 22, p. 451, 1890.
G. Englerianus P. Henn., in Engl. *Bot. Jahrb.*, vol. 14, p. 361, 1891.
G. Morganii Lloyd, *Myc. Notes*, p. 80, 1901.
G. violaceus Lloyd, *l.c.*, p. 310, 1907.

Plants superficial, ovate, pointed, becoming expanded, when 2-13 cm. across. Exoperidium split to about the middle into 5-8 equal, narrowly acuminate rays, which are expanded or revolute; fleshy layer umber, rimose, frequently partially flaking away, sometimes a small portion persisting as a small collar around the base of the endoperidium; exterior free from debris, bay brown or tan coloured, glabous, usually marked with several longitudinal striae; base plane, with a prominent umbilical scar.

Endoperidium sessile; depressed-globose or almost pulvinate, bay brown or umber, tomentose, finely pitted or smooth, membranous, 0.5-2.5 cm. diam. Peristome fibrillose, mammose, seated on a broad, depressed, silky, pallid zone which is usually outlined by an upraised margin.

Gleba ferruginous to umber; columella clavate or indistinct. Spores globose, 4.1-4.9 mmm. diam.; epispore almost black, finely and closely verrucose, reticulate.

Habitat: In groups on decaying vegetable debris; epigaean.
Distribution: Britain; Europe; North and South America; Java; Australia; Tasmania; New Zealand.
Weraroa, Wellington, Aug., 1919, *G.H.C.* (2 coll.: det. by Lloyd as *G. Englerianus*); May, 1923, *J. C. Neill!*
Dunedin, Otago, May, 1922, *Miss H. K. Dalrymple!*
Whakatikei, Wellington, June, 1923, *J. C. Neill!*

Characterized by the glabrous exterior of the exoperidium, the base of which is marked with a prominent umbilical scar, the prominent peristome and the epigaean habit.

7. **Geaster floriformis** Vittadini, *Mon. Lyc.*, p. 23, 1842. (Fig. 37.)

G. delicatus Morgan, *Am. Nat.*, vol. 21, p. 1028, 1887.
G. hungaricus Hollos, *Gast. Hung.*, p. 64, 1904.

Plants at first globose, submerged, becoming superficial and expanded when 2-6 cm. across. Exoperidium split to about the middle ito 7-12 subequal, narrow, acute rays which are expanded when wet, strongly involute when dry, then folding completely over (rarely

under) the endoperidium; fleshy layer adnate, smooth, umber, rimose when old; exterior at first covered with debris held by the closely adnate mycelial layer, soon flaking away and leaving exposed the glabrous, ochraceous or brown fibrillose layer; base strongly umbilicate.

Endoperidium up to 1.5 cm. diam., sessile, depressed-globose, minutely furfuraceous, glabrous when old. Mouth naked, indefinite, conical or more frequently plane, irregularly torn and apically fibrillose when old.

Gleba umber; columella small, cylindrical. Spores globose, or subglobose, 5.4-7.4 mmm.; epispore dark brown, closely and coarsely warted.

Habitat: In small groups on the ground in grassy areas; hypogaean.

Distribution: Europe; North America; South Africa; Australia; New Zealand.

Masterton, Wairarapa, May, 1923, *Unknown collector!*
Dunedin, Otago, May, 1923, *Miss H. K. Dalrymple! !*
Ashburton, Canterbury, Aug., 1925, *J. C. Neill; D. W. McKenzie!*

The hygroscopic exoperidium, sessile endoperidium and naked, indefinite mouth, characterize the species. The large spores also are a marked feature.

DOUBTFUL AND EXCLUDED SPECIES.

G. affinis Colenso, *Trans. N.Z. Inst.*, vol. 16, p. 362, 1883. This is probably a synonym of *G. triplex* or *G. velutinus*, but impossible to place owing to the faulty description. No specimens are known.

G. coronatus Col., *l.c.* Probably a synonym of *G. triplex*, but as no specimens are known the matter cannot be settled. In any case the name is preoccupied.

G. fimbriatus Fr. Recorded from New Zealand by De Toni in Saccardo's *Sylloge Fungorum*, vol. 7, p. 83, 1888. The writer has not seen specimens of this species from New Zealand, although he has examined many Australian collections. The record is probably based on a small form of *G. triplex*.

BIBLIOGRAPHY.

BERKELEY, J. M., 1860. Fungi, in Flora of Tasmania. Hooker's *Botany of the Antarctic Voyage*, vol. 2, p. 260.

BONORDEN, H. F., 1857. Die Gattungen Bovista, Lycoperdon u. ihr Bau. *Bot. Zeit.*, vol. 15, p. 593, 609, 625.

COKER, W. C., 1924. The Geasters of the United States and Canada. *Journal of the Elisha Mitchell Scientific Society*, vol. 39, p. 170.

COOKE, M. C., 1892. *Handbook of Australian Fungi*, 457, pp. London.

CUNNINGHAM, G. H., 1925. The Gasteromycetes of Australasia, III.: The Genera Bovista and Bovistella. *Proc. Linn. Soc.* N.S.W., vol 50, p. 367.

—— 1926. The Gasteromycetes of Australasia, IV.: Species of the Genus Geaster. *Proc. Linn. Soc.* N.S.W., vol. 51, p. 72.

CZERNAIAIEV, B. M., 1845. Nouveaux cryptogames de l'Ucraine. *Act. Mosc.*, vol. 2, p. 132.

de Toni, J. B., 1888. Lycoperdaceae, in Saccardo's *Sylloge Fungorum*, vol. 7, p. 60.
Fischer, Ed., 1900. Gasteromycetes in Engler and Prantl's *Natuerlichcn Pflanzenfamilien*, Teil, I., Abt. 1**, p. 190.
Fries, E. M, 1829. *Systema Mycologicum*, vol. 3, 210 pp. Lundae.
—— 1849. *Summa Vegetabilium Scandinaviae*, 313 pp. Lipsiae.
Hollos, L., 1903. Die Arten der Gattung Disciseda Czern. *Hedwigia*, vol. 42, p. 20.
—— 1904. *Die Gasteromycetes Ungarns*, 210 pp., Budapest.
Lloyd, C. G., 1901 *et seq. Mycological Notes*, Cincinnati.
—— 1902. *The Geastreae*, 44 pp., Cincinnati.
—— 1905a. *The Lycoperdaceae of Australia, New Zealand and Neighboring Islands*, 44 pp., Cincinnati.
—— 1905b. The Lycoperdons of the United States. *Mycological Notes*, p. 221.
—— 1905c. The Genus Lycoperdon in Europe. *Mycological Notes*, p. 205.
—— 1906. The Genus Bovistella. *Mycological Notes*, p. 277.
Massee, G. E., 1887. A Monograph of the Genus Lycoperdon (Tournef.) Fr. *Journal of the Royal Microscopical Society*, p. 701.
—— 1891. A Monograph of the British Gastromycetes. *Annals of Botany*, vol. 4, p.l.
Morgan, A. P., 1884. The North American Geasters. *American Naturalist*, vol. 18, p. 963.
—— 1887. The Genus Geaster. *American Naturalist*, vol. 21, p. 1026.
—— 1890. North American Fungi. Third Paper; The Gasteromycetes. Order II.; Lycoperdaceae. *Journal of the Cincinnati Society of Natural History*, vol. 12, p. 8. 163.
Morgan, A. P., 1892. North American Fungi, V. *Journal of the Cincinnati Society of Natural History*, vol. 14, p. 141.
—— 1895. North American Fungi. *Ibid.*, vol. 18, p. 36.
Persoon, C. H., 1801. *Synopsis Methodica Fungorum*, 706 pp., Gottingen.
Rea, Carleton, 1922. *British Basidiomycetae*, 799 pp., Cambridge.
Smith, W. G., 1873. British Geasters. *Gardeners Chronicle*, p. 1, 608.
Verwoerd, Len., 1925. Suid-Afrikaanse Lycoperdaceae en Nidulariaceae. *Annale van die Uniwersiteit van Stellenbosch*, Jaargang 3, Reeks A, no. 1, p.l.
Vittadini, C., 1842. *Monographia Lycoperdineorum*, 93 pp. Turin. (reprint from *Memorie della reale Accademia delle scienze di Torino*, ser. 2, vol. 5, pp. 145-237, 1843.

Index to Species and Genera.

All synonyms are in italics. Page numbers of synonyms and incidental references are in ordinary type; those under which are to be found descriptions of species and genera are in italics. Only synonyms used in recent literature, or that are some guide to the species under discussion, are given here.

Four Fungi on the Endemic Species of *Rubus* in New Zealand.

By B. JEAN MURRAY, B.Sc., Assistant Mycological, Cawthron Institute, Nelson.

[*Read before the Nelson Philosophical Society, 5th December, 1925; received by Editor, 9th December, 1925; issued separately, 1st December, 1926.*

In April, 1925, the writer was collecting fungi along the main West Coast road between Nelson and Murchison in the region of the Gowan River. At this place the dense, wet, bush-clad hillside rises steeply above the road on the one side, while on the other flows the river, with its banks also bush-clad. The fringe of the bush on both sides of the road has been partially cleared and is now covered with blackberry and tataramoa, the prickly New Zealand "bush-lawyer" (*Rubus australis*). On some of the latter bushes leaves were found with the orange spots and long filamentous spore-threads of *Hamaspora acutissima* Syd., hitherto unrecorded for this district. On other lawyer-bushes close by it was noticed that numerous leaves and some very young twigs were covered with the dense white felt of a powdery mildew; specimens were collected which, on examination, showed the perithecial stage of the fungus as well as numerous rather old conidia. Unfortunately the leaves had to be kept some time before an opportunity of studying them arose, so that details of haustorial and conidial development (other than measurements of mature conidia) could not be obtained.

With the object of procuring more specimens of the mildew the bush round Nelson was explored and many samples of "bush-lawyer" collected, none of which, however, showed the mildew, although a number of other fungi were found, descriptions of some of which are included in this paper. The four fungi particularly referred to are *Erysiphe carpophila* Syd. n. var. *rubicola, Phyllosticta variabilis* Peck, *Pestalozzia antennaeformis* n. sp., and *Coryneum Ruborum* Oud.

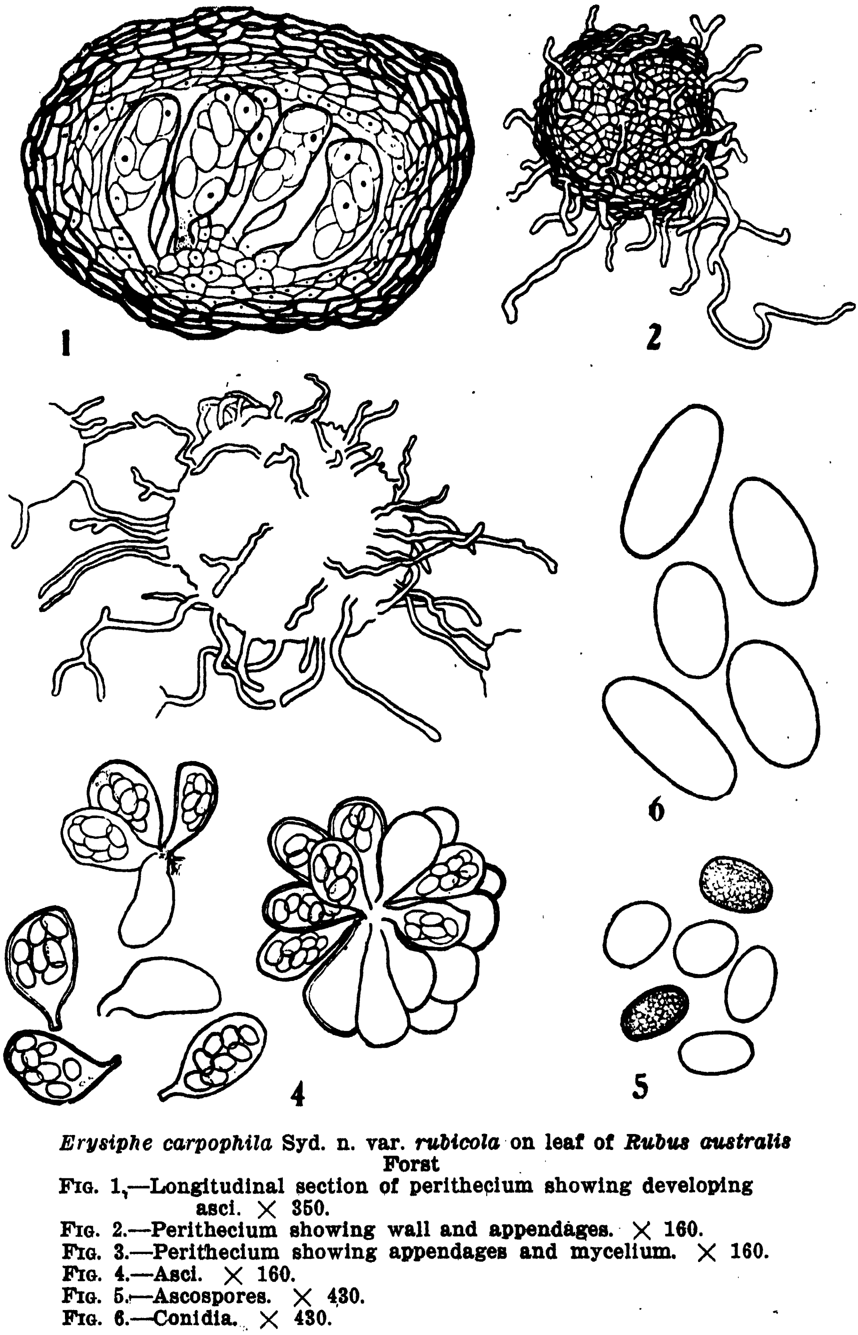
Erysiphe carpophila Syd. rubicola.

This mildew was collected on two types of *Rubus australis* Forst. on the leaves only of the broad-leaved type, but on the leaves, twigs, and buds of the narrow-leaved. Conidia only were found on the twigs and buds, while on the leaves of both forms both old conidia and perithecia were present. The perithecia, however, were mature only on the broad-leaved specimens at the time of collection.

The mycelium forms white felty patches irregular in shape and size, which in time tend to become dense, but may be sparse and powdery when young or where less developed; chiefly hypophyllous, rarely epiphyllous also; consisting of superficial, dense, branching and intertwined hyaline hyphae, 3-5 mmm. thick. (Figs. 14, 15).

The perithecia are numerous, scattered, hypopyllous, superficial, golden brown, becoming dark brown, spherical, 90-140 (most 100-120) mmm. in diameter; the wall consists of two or three layers

of thick-walled sclerenchymatous cells on the outside merging gradually into the thin-walled cells surrounding the asci (Fig. 1); attached to the perithecia are appendages which are sparse or numerous;



Erysiphe carpophila Syd. n. var. *rubicola* on leaf of *Rubus australis* Forst

FIG. 1.—Longitudinal section of perithecium showing developing asci. × 350.
FIG. 2.—Perithecium showing wall and appendages. × 160.
FIG. 3.—Perithecium showing appendages and mycelium. × 160.
FIG. 4.—Asci. × 160.
FIG. 5.—Ascospores. × 430.
FIG. 6.—Conidia. × 430.

intermixed with and difficult to distinguish from the hyphae of the mycelium, straight to much contorted or knotted, occasionally slightly branched, hyaline or very rarely faintly fuliginous, 25-100 mmm. long or exceptionally up to 1.5 times the width of the perithecium (usually equal to one half to the whole diameter of perithecium), 3-5 mmm. thick. (Figs. 2 & 3).

There are 4-17 asci in each perithecium; paraphyses are absent; asci 8-spored, saccate to ovate-oblong, often irregular in shape, 58-82 mmm. long by 28-36 mmm. wide, with a short broad stalk 8-13 x 5-6.6 mmm.; wall of ascus 1.7 mmm. wide. (Fig. 4.)

The ascospores are continuous, hyaline, almost spherical to broadly elliptical, 13-21.5 x 10-12.4 mmm., with granular contents. (Fig. 5.)

The conidia are continuous, hyaline, rounded, or oblong-elliptical to oblong-cylindrical with bluntly rounded ends, ranging from 28-40 mmm. long by 13-18 mmm. wide. (Fig. 6.)

Habitat,—On living leaves and twigs of *Rubus australis* Forst. West Coast Road, Nelson, 15/4/25., *K. M. Curtis* (Myc. Herb. No. 354).

Five species of *Erysiphe* are recorded for New Zealand, but in the major features of number, shape and size of asci and ascospores the fungus on *Rubus* agrees only with *E. carpophila* Syd. (Sydow, 1924, p. 294) on *Weinmannia sylvicola* Sol.

In the latter fungus, however, the perithecia are somewhat larger and their appendages longer. Moreover, in the single set of material from which the description of *E. carpophila* was drawn up, it occurred on the capsules only, the leaves being uninfected. But in view both of the agreement of the fungi in their more important characteristics and also of the wide range of hosts upon which the common species of *Erysiphe* are found, it seems advisable at present, considering our ignorance of the distribution of *Erysiphe* on native plants, to record the form on *Rubus* as a form of *E. carpophila* rather than to assign it immediately to a new species. The new form is therefore designated *E. carpophila* Syd. var. *rubicola.*

Phyllosticta variabilis Peck.

This fungus was found causing leaf-spots on *Rubus cissoides* A. Cunn. and *Rubus australis* Forst. growing along the banks of a creek in Mr. Whitwell's bush, Wakapuaka. It was also found on twigs of *R. cissoides* infected with *Pestalozzia antennaeformis.* The following is a description of the fungus and its appearance on the host:—

There may be one to three large spots upon each leaflet with occasionally in addition several much smaller spots; the spots may be either terminal forming light brown dead areas at the tip, sometimes extending to 3 cm. from the apex, marginal when they are roughly semicircular and up to 1 cm. in diameter, or internal and circular up to 0.5 cm. in diameter. The infected spot starts in all cases as a small purplish or dark red area which, as it extends and ages becomes zoned, showing a central white or greyish white portion surrounded in turn by a light brown zone (which, if large, may show secondary zoning), a chocolate-brown or blackish zone, and, finally,

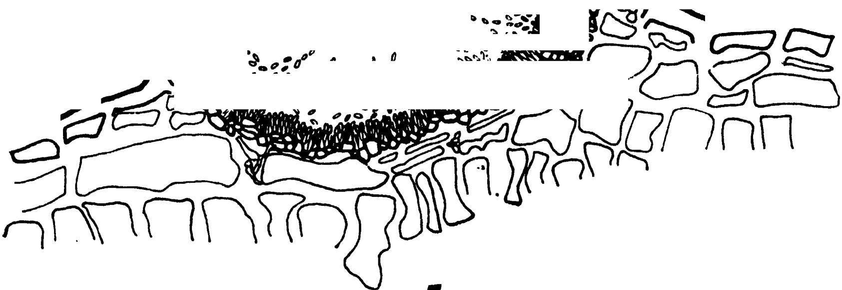
by a dark red or purplish red margin, delimiting it from the green, healthy part of the leaf. One or more of these zones may be absent. The spot and zoning show more markedly upon the upper surface of the leaf; the zoning may sometimes be seen on the lower surface, but there the spot is usually brown, surrounded by a dark margin. (Fig. 16).

Upon the leaf-spot are a few scattered pycnidia (Fig. 17) which are chiefly epiphyllous, black, erumpent, punctiform, globose-depressed to lenticular, 160-280 mmm. wide by 90-150 mmm. high, with a thin wall two or three cells thick (in parts more), cells very small, about 3 mmm., somewhat thickened, light brown. (Fig. 7.)

The conidiophores are hyaline, simple, obpyriform to ventricose, bearing one conidium at the tip, 7.5-10 mmm. long in all, swollen lower portion 3 mmm. wide, attenuated portion 3-4 mmm. long by 0.8 mmm. wide. (Fig. 8.)

The conidia are hyaline, one-celled, cylindrical to elliptical, 5-6.6 mmm. by 1-2.5 mmm.

Habitat,—On living leaves of *Rubus cissoides* A. Cunn., 20/7/25, and *R. australis* Forst., 21/9/25, Wakapuaka, *B. J. Murray* (Myc. Herb. Nos. 349a, 349b).



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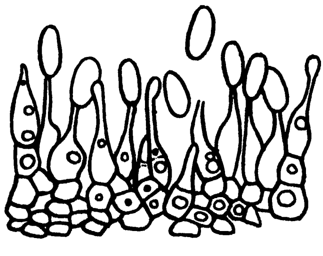

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Phyllosticata variabilis Peck, on leaf of *Ruvus cissoides* A. Cunn.

FIG. 7.—Section through a pycnidium. × 320.

FIG 8.—Detail of pycnidium showing attachment of spores to conidiophores. × 1040.

The form of *Phyllosticta variabilis* Peck (1884, p. 138) occurring on the local species of *Rubus* agrees in all major features with that originally described, which was found on *Rubacer odoratus* (L.) Rydb. (*Rubus odoratus,* L.) but exhibits slight variations, such as the smaller number and somewhat larger average size of the pycnidia and their occurrence at times on the lower surface of the leaf. These variations, however, are not greater than might be expected to be shown by cultures of any organism on different hosts. The possibility of the present species being either *P. Ruborum* Sacc. or *P. Dearnessii* Sacc. also occurring on *Rubus* sp., is excluded by the small size of the spores in the two last-named fungi.

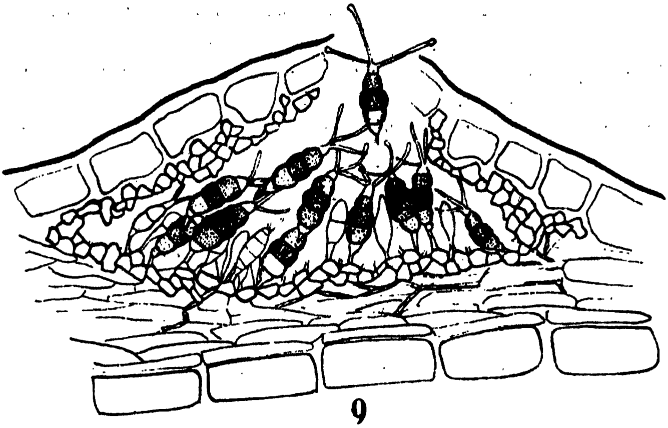
Pestalozzia antennaeformis n. sp.

The minute acervuli of this fungus were found uniformly and densely distributed over large cankered areas on living stems of an isolated bush of *Rubus cissoides* A. Cunn. growing in the Botanic Reserve, Nelson, and later on a bush of the same species at Wakapuaka. The cankers stretch from a few inches to several feet along, and wholly or partially surround the stem. The bark is not ruptured except where the acervuli break through the surface, the canker merely appearing as a light brown dead area slightly sunken below and in marked contrast with the green uninfected regions. (Figs. 18, 19.) A search was made for the same fungus on the leaves and, although none was found on the living leaves, dead leaves on the Nelson bush showed on microscopical examination the presence of a species of *Pestalozzia* identical in character with that on the twigs. Finally the same fungus was discovered on living leaves, but of a different species of *Rubus (R. australis)* at Wakapuaka. In the latter case a few acervuli occurred on dead spots on the living leaves in conjunction with other fungi; it has not so far been seen on the stems of this species.

The acervuli are numerous, gregarious, scattered over large light brown areas on the living stems, minute, circular, flat then erumpent, 132-165 mmm. in diameter. (Fig. 9.)

The spores are fusoid, straight or curved, 5-celled, constricted at the septa, 21-31.6 x 6.6-9 mmm.; the cells vary in intensity of colour, the three middle ones being olivaceous, darker in the upper two; the basal cell is usually the smallest, light olivaceous to hyaline, with a short pedicel 3-6.6 x 1 mmm. Some young, uncoloured conidia still attached to the acervuli were found with pedicels considerably larger, up to 11.5 x 2.5 mmm., but this was only in very isolated instances. The uppermost cell is smaller than the middle ones, hyaline, conical, bearing a little below the rounded apex and continuous with the cell, usually three, simple, equal, hyaline cilia, the ends of which are most frequently dilated into a small round knob, all reflexed more or less at right angles to the long axis of the spore, 13-50 mmm. long by 1-1.5 wide. Occasionally there may be two or four cilia, and very rarely they may fork. (Fig. 10.)

Habitat,—On living stems and dead leaves of *Rubus cissoides* A. Cunn., Nelson, 19/7/25 and Wakapuaka, 20/9/25, and on living



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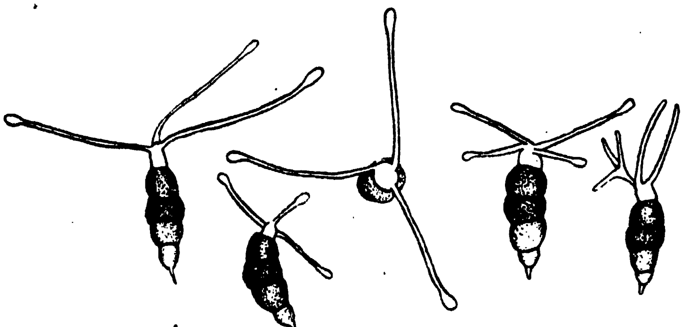
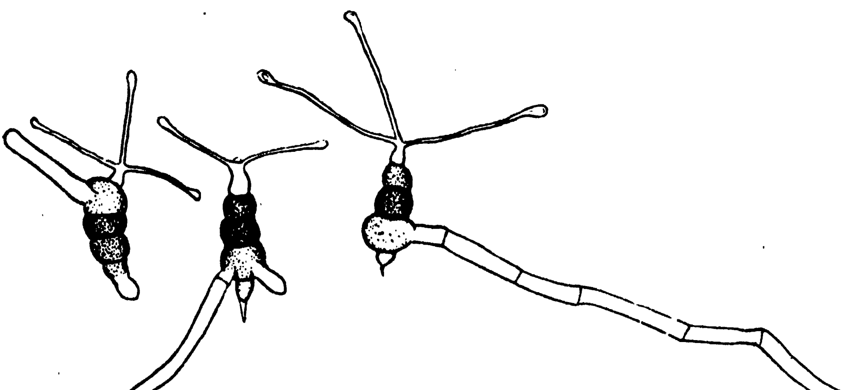


A B 10 C D E



11

Pestalozzia antennaeformis n.sp., on stem of *Rubus cissoides* A. Cunn.

FIG. 9,—Section through an acervulus. × 360.
FIG 10.—A, B, C, Typical Spores; D, E, Irregular Spores. × 430.
FIG. 11—Germinating Spores. × 430.

leaves *R. australis* Forst., Wakapuaka, 20/9/25. *B. J. Murray* (Myc. Herb. Nos. 355a, 355b).

The spores germinate readily in water. The cell above the basal cell or less commonly one of the other cells, swells considerably, appearing lighter in colour than before, and puts forth a germ-tube, or two, which cuts off a wall and rapidly proceeds to form a long, sparsely septate, hyaline hypha, which eventually branches and forms the new mycelium (Fig. 11).

This species of *Pestalozzia* differs in many respects from the other species recorded on *Rubus,* most nearly resembling *P. longiseta* Speg. (Sacc., Syll. *Fung.,* vol. 3, 1884, p. 787) from which it is distinguished by larger spores, shorter pedicels, and the characteristic regularly arranged clubbed cilia which are also, on the whole, comparatively shorter. The present species is therefore considered distinct and is named *Pestalozzia antennaeformis* n. sp.

Coryneum Ruborum Oud.

This fungus was occasionally found with *Pestalozzia antennaeformis* on cankers on living stems of *Rubus cissoides,* and still more rarely on dead spots on living leaves of *R. australis.*

In view of the fact that the *Coryneum* found on endemic species of *Rubus* in N.Z. has a greater range of spore colour and size than is given in the descriptions of *C. Ruborum* Oud. in Saccardo's Syll. Fung. (vol. 2, 1883, p. 576) and Rabenhorst's *Kryptogamen-Flora* (vol. 7, 1903, p. 657) a short description of the fungus found locally is given below. However, Zellar (1925, p. 40) describes *C. Ruborum* as having a range which more nearly approaches that of the N.Z. species which is excluded from *C. microstictum* B. & Br. by not having honey-coloured spores and from *C. foliicolum* Fuck., a leaf-dwelling species, by having on the average slightly smaller spores.

The acervuli are scattered, black, circular to elliptical, flat, erumpent, 150-360 x 100-200 mmm. (Fig. 12); the spores are elliptical more obtuse at the apical end, straight or curved, 13-18 x 5-7 mmm., 4-locular, constricted at the septa, yellowish-olivaceous (sometimes with yellow hue predominant, at other times almost fuliginous), basal cell sometimes paler and attentuate, uppermost cell rounded conical; pedicels hyaline, filiform, 15-23 x 1.2-15 mmm. (Fig. 13a.)

Habitat,—On living stems of *Rubus cissoides* A. Cunn., Nelson, 2/11/25, and living leaves of *R. australis* Forst., Wakapuaka, 21/9/25, *B. J. Murray.* (Myc. Herb. Nos. 357a, 357b.)

Spores of this fungus germinate readily in water. Prior to germination the cells swell considerably, becoming almost spherical and much lighter in colour; at this stage the spores may be as much as 25 mmm. long by 13 mmm. wide. Any one or more of the cells may put forth a short germ-tube, which rapidly grows to form a hyaline hypha occasionally septate and about 3-5 mmm. wide, which soon branches to form the new mycelium, (Fig. 13b).

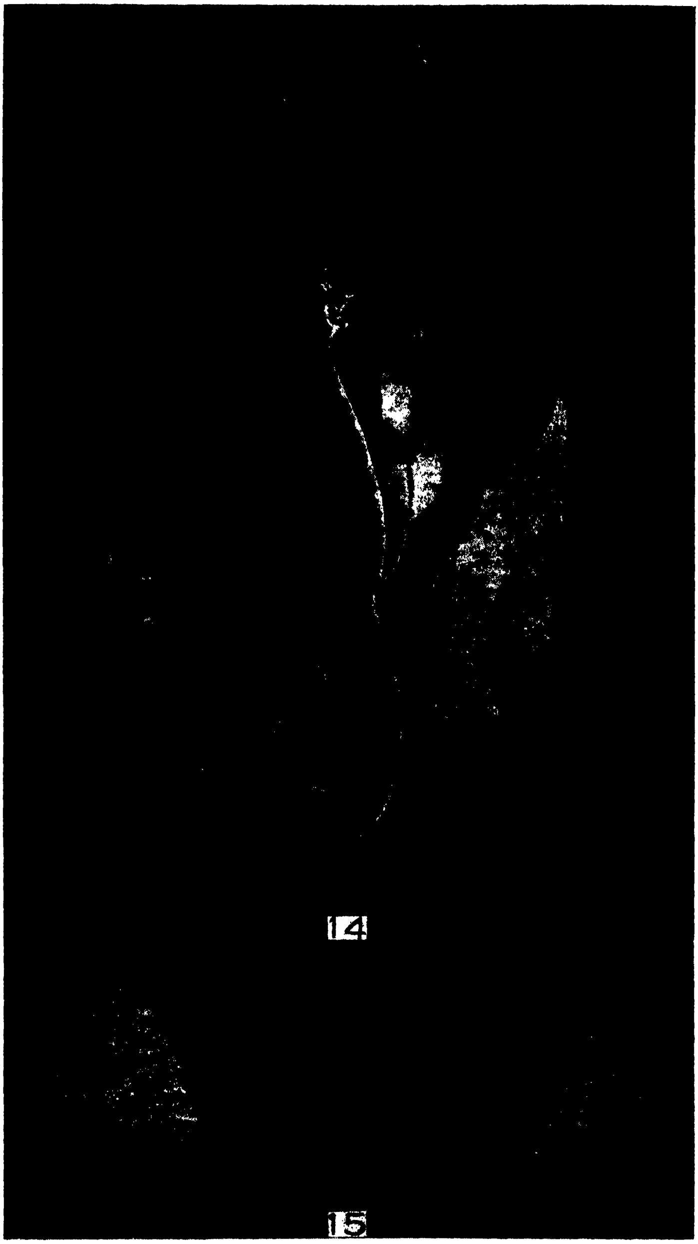


Photo: W. C. Davies.

Erysiphe carpophila Syd. n. var. *rubicola*.

Figs. 12 and 13.—(*See* page 225).

Fig. 14.—On *Rubus australis* Forst.

Fig. 15.—Enlargement to show perithecia on the white mycelium.

Face p. 224.

16

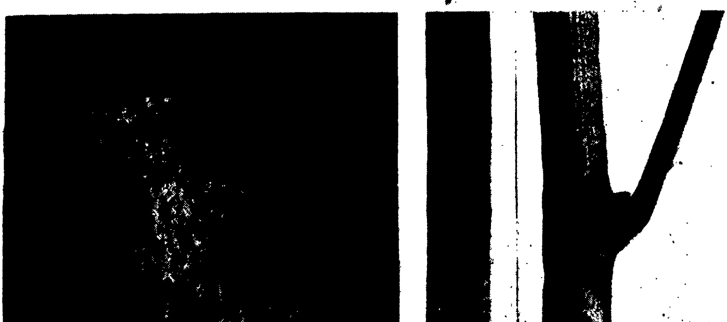


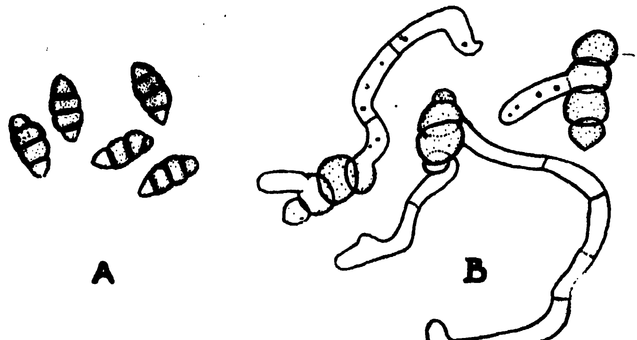
Photo: *W. C. Davies.*

FIG. 16.—*Phyllosticta variabilis* Peck, on *Rubus cissoides* A. Cunn.

FIG. 17.—*Phyllosticta variabilis* Peck, on *Rubus cissoides* A. Cunn. showing pycnidia.

FIGS. 18 & 19.—*Pestalozzia antennaeformis* n.sp., on *Rubus cissoides* A. Cunn. Note the sharp contrast between diseased and healthy tissue. Arrow points to acervuli.

12



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Coryneum Ruborum Syd. on stem of *Rubus cissoides* A. Cunn.

FIG. 12.—Section through an acervulus. × 200.
FIG. 13.—A, Spores; B, Germinating Spores. × 430.

The writer wishes to thank Dr. K. M. Curtis, of this Institute, for much help and advice, and Mr. W. C. Davies, also of this Institute, for the photographs.

LITERATURE CONSULTED.

PECK, C. H., 1884. *Ann. Rept. New York State Museum Botany, 35*, p. 138. Refs.: Sacc. *Syll. Fung.*, 10 (1892) 110; *North American Flora*, 6 (1922) 49.

RABENHORST, L., 1903. *Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz*, 2nd Edn., 1 Bd., 7 Abt., p. 657.

SACCARDO, P. and A., 1882–1925. *Sylloge Fungorum*: 3 (1884) 787; 10 (1892) 110; 11 (1895) 576.

SPEGAZZINI, C. *Sacc. Mich.*, 1, p. 478. Ref.: *Sacc.*, *Syll. Fung.*, 3 (1884) 787.

SYDOW, H., 1924. *Beitraege zur Kenntnis der Pilzflora Neu-Seelands*, 1. *Annales Mycologici*, 22, pp. 293–317.

ZELLER, S. M., 1925. *Coryneum Ruborum* Oud. and its ascogenous stage. *Mycologia*, 18, pp. 33–41.

The Geology of the Ruakokopatuna Valley, Southern Wairarapa.

By R. J. WAGHORN, M.A.

[*Read before the Wellington Philosophical Society, 8th July, 1924; received by Editor, 16th December; 1925; issued separately, 7th December, 1926.*]

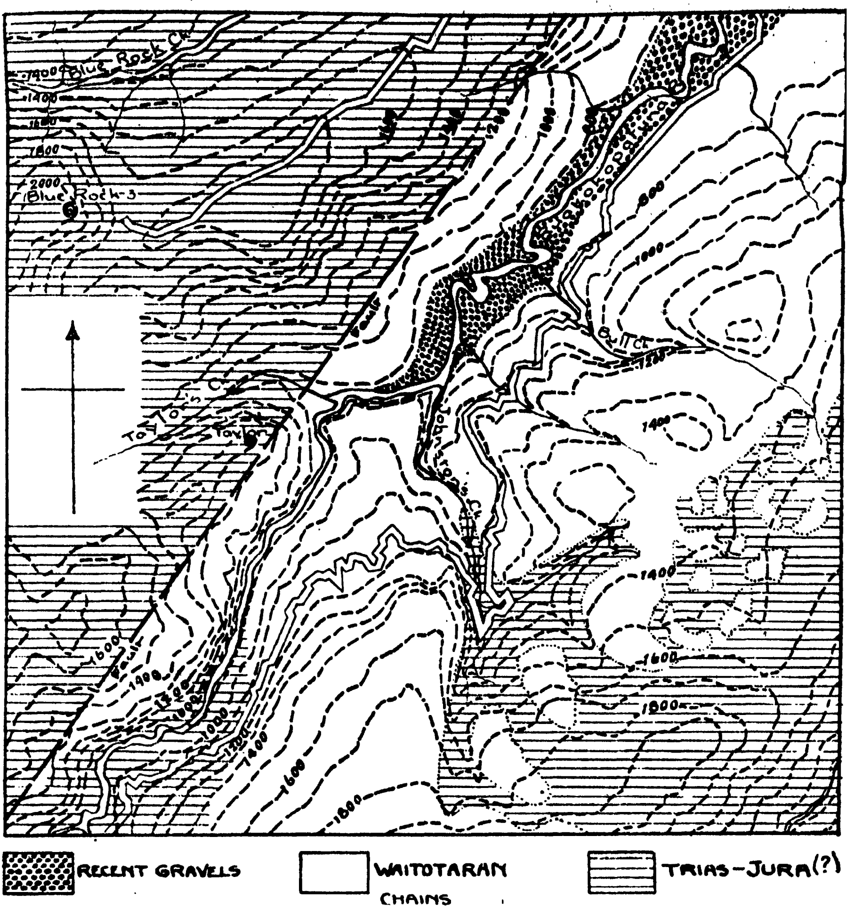
INTRODUCTION.

The area herein mapped and described lies in the Haurangi Mts. in the south-eastern portion of the North Island. The map itself represents part of the middle course of the Ruakokopatuna River with its enclosing valley sides. In its middle reaches the trend of the valley is regular, and in an approximately N.E. direction. This regularity of trend is due to the fact that the river has its course in the fault-angle depression between two differentially uplifted and tilted blocks. The valley sides, both in form and structure, afford a striking contrast, that to the north-west being a maturely dissected fault-scarp of greywacke (Cotton, 1922, p. 161, fig. 167), that to the south-east a generally smooth and much less steeply inclined though somewhat dissected dip-slope of limestone.

These gently inclined limestone rocks rest with marked unconformity upon a smooth floor of greywacke, which in places is revealed owing to the stripping away of the covering strata. In structure and in composition this undermass of the dip-slope is similar to the greywacke forming the fault-scarp on the opposite side of the valley. The fault itself has nowhere been observed in section, being covered by talus from the disintegrating greywacke. For this reason it has been mapped as a straight line, though it is scarcely probable that this is its true form.

PHYSIOGRAPHICAL.

The distinctly asymmetrical contour of the valley is perhaps its most outstanding feature. This marked difference in slope, combined with the difference in composition and structure of the rocks on opposite sides of the valley, has given rise to two distinct types of erosion. With the exception of Taylor Creek, no streams of any importance arise on the fault-scarp. The descending spurs are maturely eroded, as are the intervening depressions. On the dip-slope of the lower and thicker member of the limestone series which forms the greater part of the surface of the opposite side of the valley, erosion appears still to be in the youthful stage, though in reality strata overlying the limestone have been stripped off by erosion. Streams consequent upon this dip slope are numerous and for the most part deeply entrenched. In the upper reaches of Johnston Creek the covering strata have been removed and the stream flows on the greywacke rocks. To the east, beyond the headwaters of this stream, the crest of the divide consists of greywacke exposed by removal of the limestone.



Geological Map of part of the Ruakokopatuna Valley.

Evidence of recent uplift is supplied by the preservation, in the northern part of the area, of remnants of two distinct terraces at a height, in the case of the upper, of 130 ft., and of the lower, 80 ft. above the present level of the stream. Originally, no doubt, the river had its course in the actual fault-angle. Through the accumulation of waste from the steep fault-scarp it has been forced up the dip-slope till it now occupies a position in general somewhat removed from the actual fault. From it's junction with Johnston Creek south-westward over a mile of its course, the river is deeply and narrowly entrenched in the limestone rocks.

Solution of the Limestone.—The limestone presents the topographic features typical of areas in which such rocks occur. Sinkholes are of common occurrence, many of them, as evidenced by their linear disposition, leading down into channels of underground drainage that maintain their subterranean character until they emerge

in the bed of one of the streams or in the river itself. Many of the sinkholes are open, though their surface diameter seldom exceeds 20 ft. In other cases the underground drainage-system does not extend to the surface as open sinkholes, but is made evident in such instances by a series of depressions in which the water collects and from which it would appear to seep to the underground channel.

The Fault-scarp.—The fault strikes approximately N. 34° E. and dies out in this direction outside the area mapped. Talus from the fault-scarp effectually conceals the direction and amount of hade, and in no part of the area is this clearly revealed. From the attitude of the limestone, however, it may reasonably be assumed that the fault is a normal one, hading towards the south-east, for the limestone is not upturned along the junction.

View looking S.W. up the Ruakokopatuna valley. The hill-side to the right of the fault is composed of greywacke.

The Fault-scarp Problem. In 1920 Mr. C. Lamplugh, President of the Geological Society, in a discussion arising out of the paper by S. Shand, entitled "A Rift-Valley in Western Persia"* "commented on the numerous points of interest illustrated by the paper. Not only did it describe an excellent example of trough-faulting but it showed also how easily fault features developed by erosion might be mistaken for surface exhibitions of faulting. We had still to discover what may be the possible limits of surface displacement by fault-movement. In all the observed cases of recent faulting the displacement at any one time was too slight to affect the general course of the drainage.... Physiographical evidence usually indicates that even the biggest faults are of slow growth. The existence of recent fault-scarps of great size is often stated, but the evidence is most unconvincing."

**Quart. Journ. Geol. Soc.* vol. 75 p. 249.

In the light of these expressed opinions it is of interest to examine the geological evidence as to the origin of the Ruakokopatuna Valley.*

The covering strata dip towards and end abrubtly against the greywacke forming the north-western side of the valley, which has been described above as a fault-scarp. This as has already been stated, would prove tilting of a block as well as separation of blocks by faulting. The crest of the divide (beyond the westerly limit of the map) above the fault-scarp is some 1250 feet above the plane of junction of the limestone and greywacke as exposed in the Ruakokopatuna River. Since no limestone is found along this divide (all the cover having been removed since the uplift of the north-western block) the minimum amount of displacement at this point is in the region of 1300 ft. If the origin of the Ruakokopatuna valley is due to subsequent erosion along the fault-line with the removal of a great thickness of strata younger than those now present in the valley, it would be expected that these younger beds would somewhere be preserved. However, no younger rocks have so far been discovered, either in the direction in which the fault dies out, or in the direction in which the covering strata dip. On the other hand, rocks of similar age are found to the north, dipping under the gravels of the Wairarapa Plain.

Judging from the nature of the differential movements—*i.e.*, combined faulting and tilting—in this area, it would seem that a course consequent in the fault-angle depression so formed must be established for the river. The very considerable amount of displacement strengthens this supposition. The conclusion that the valley is not due to fault-line erosion, but that it is of consequent origin would appear sufficiently well established.

THE GREYWACKE ROCKS.

These basement rocks are much folded and highly inclined, with a general strike of about N. 10° E. In the absence of fossils no certain determination of their age can be made. Their lithological character would correlate them with those rocks forming a great part of the present mountain systems of New Zealand, and classified by Marshall (1912) as of Trias-Jura age.

THE YOUNGER ROCKS.

A section west to east from the Wairarapa Plains at Masterton, some 30 miles north of the area here described, reveals the Tertiary rocks dipping towards the West. The Wairarapa Limestone of Waitotaran age (Thomson 1919) forms the highest member of a series of sandstones, mudstones, and limestone. The limestone and sandstone beds form steep escarpments facing eastwards towards the coast.

In the Ruakokopatuna Valley the thick clastic strata below the limestone are absent, and the younger rocks rest upon an almost plane truncated surface of the greywacke series. Being present as a veneer on the SE. side of the tectonic valley, they strike N. 53° E. and have a general dip of about 15° towards the north-west. The greatest

*COTTON (1922) from physiographical evidence, inferred a fault-valley origin for the Ruakokopatuna R.

thickness of the beds exposed is 700 ft. This thickness of strata occurs in the south-west portion of the area, to the west of the river. It owes its preservation to its position in the fault-angle and to the shifting of the river up the back slope of the tilted block forming the opposite side of the valley. On the dip-slope itself the limestone, where not entirely stripped away, has been much reduced in thickness through the combined agencies of erosion and solution.

The sequence in the covering strata is as follows:—

4. Upper Shelly Limestone.
3. Blue Sands 150 ft., followed by 30 ft. of brown sandy beds: both of these are unconsolidated, with numerous intercalated shell-beds.
2. Lower Shelly Limestone 250 ft.
1. Glauconitic Sand 5 ft.

Description of Strata.

1. *Glauconitic Sand.* The materials composing this band are extremely friable at the base, but towards the top they become progressively more compact and less glauconitic. The brachiopods *Terebratulina suessi* Hutton and *Neothyris* sp. occur throughout the band, but are most numerous towards the base, where they constitute the greater part of the rock. Of the remaining constituents the greensand in the first three feet makes up by far the greater part. In the upper two feet of the layer the greensand is replaced largely by a moderately fine calcareous sand. In addition there is a small percentage of fine argillaceous material. Under the microscope the individual grains of glauconite are seen to vary in size up to 1 mm. in diameter. They possess in the majority of cases rounded and polished surfaces, though instances are common of botryoidal and angular forms. From the varying character of the grains little can be learned as to their mode of origin.

The only fossils collected from this stratum were the brachiopods mentioned above.

2. *The Lower Shelly Limestone.* The glauconitic band is followed by an impure limestone rock that is composed for the major part of comminuted shells, with, in the different beds, a varying admixture of sand and sparsely distributed small pebbles. The layers vary considerably in texture and in the degree to which they have been consolidated.

The occurrence throughout these beds of graywacke pebbles, coupled with an almost complete absence of other land-derived materials, is difficult of explanation. The pebbles vary in diameter from 3 inches down to very small dimensions. The larger pebbles frequently exhibit a decidedly angular appearance and seem to have suffered little abrasion. The smaller ones, however, are more rounded though traces of angularity are still apparent. This angularity would argue a not far distant source for the greywacke pebbles. Such a conclusion seems, however, at variance with that reached after a study of the other features of the limestone.

The greater part of the limestone is made up of the fragmentary tests of *Balanus.* In this it shows a decided resemblance to the Te Aute limestone (McKay, 1879) which has been referred to the Plio-

cene. Other shells that contribute largely to the bulk of the rock are *Pecten triphooki* Zittel, and *Ostrea* sp., while in the lower horizons brachiopods are numerous. The fossils collected from this limestone are:—*Balanus* sp., *Ostrea* sp., *Pecten convexus* Quoy and Gaimard, *Pecten triphooki* Zittel, and *Terebratulina suessi* Hutton.

3. *The Blue and Brown Sands.* These rocks outcrop in Bull Creek where their full thickness is to be seen, and at the junction of Taylor Creek and the Ruakokopotuna River where only the brown sands and the upper 10 ft. of blue sands are exposed. On the river banks north of this latter locality numerous outcrops occur.

The unconsolidated blue sands rest conformably upon a strongly cemented shelly layer which for some distance forms the bed of Bull Creek. There occur, throughout the thickness of the blue and brown sands, but more frequently towards the base, numerous thin semi-consolidated shell beds in which *Chione subsulcata* Suter is common. The sands themselves are but poorly fossiliferous.

Collections were made from three localities.

THE BLUE SANDS, BULL CREEK.

Ancilla opima Marwick.
Anomia undata Hutton
Arcopagia c.f. disculus Deshayes.
Balanus sp.
Cantharidus sanguineus (Gray).
Chione subsulcata Suter.
Crassatellites n. sp.
Crepidula (sp. indeterminable).
Glycymeris waipipiensis Marwick.
Macrocallista n. sp .
Neothais lacunosa (Brugiere).
Pecten delicatulus Hutton.
Struthiolaria acuminata Marwick.
Terebra tristis Deshayes.
Turritella symmetrica Hutton.
Zenatia acinaces (Quoy & Gaimard).
Umbonium anguliferum (Philippi)

BLUE SANDS, JUNCTION RUAKOKOPATUNA RIVER AND TAYLOR CREEK.

Arca n. sp.
Balanus sp.
Chione subsulcata Suter.
Musculus impactus (Herm.).
Pecten delicatulus Hutton.
Tegulorhynchia nigricans (Sow.).
Terebratella inconspicua Sow.
Voluta sp.—a fragment.
Zenatia acinaces (Quoy & Gaimard).

BROWN SANDS, RUAKOKOPATUNA BRIDGE.

Aethocola c.f. nodosa Martyn.
Ancilla australis (Sow.).
Anomia undata Hutton.
Balanus sp.
Chione subsulcata Suter.
Glycymeris laticostatus (Quoy & Gaimard).
Lima bullata.
Marcia plana Marwick.
Modiolus n. sp.
Myllita finlayi Marwick.
Myodora striata (Quoy & Gaimard).
Ostrea, sp.
Pecten delicatulus Hutton.
Umbonium anguliferum (Philippi),
Venericardia lutea (Hutton).
Venericardia purpurata (Deshayes).
An echinid.*

4. *The Upper Shelly Limestone.* The sands described above are succeeded conformably by the Upped Shelley Limestone. This lime-

*This small regular echinid was in a good state of preservation and has been forwarded for identification to H. L. Hawkins, Reading, England.

stone is markedly similar to that lying below the sands, and again the broken tests of *Balanus* contribute the bulk of the rock. *Panope* is now also of frequent occurrence. Land-derived material is scarce and confined to sparsely distributed small angular pebbles of greywacke.

From this upper limestone, where it outcrops at the Ruakokopatuna Bridge, the following were collected: —

Panope zelandica Quoy & Gaimard.
Venericardia purpurata Deshayes.
Chione subsulcata Suter.
Turritella symmetrica Hutton.
Balanas sp.
Ostrea spp.

RECENT SPECIES.

The complete list of the specifically determined fossil molluscan fauna collected from the various beds is as follows, the recent species being marked with an asterisk: —

Aethocola c.f. nodosa Martyn.
**Ancilla australis* (Sow.).
Ancilla opima Marwick.
**Anomia undata* Hutton.
Arca n. sp.
**Cantharidus sanguineus* (Gray).
Chione subsulcata Suter.
Crassatellites n. sp.
**Glycymeris laticostata* (Quoy & Gaimard).
Glycymeris waipipiensis Marwick.
**Lima bullata* (Born).
Macrocallista n. sp.
Marcia plana Marwick.
Modiolus n. sp.
**Myodora striata* (Quoy & Gaimard).
**Musculus impactus* (Herm).
**Neothais lacunosa* (Brugiere).
**Panope zelandica* Quoy & Gaimard.
**Pecten convexus* Quoy & Gaimard.
Pecten delicatulus Hutton.
Pecten triphooki Zittel.
Struthiolaria acuminata Marwick.
**Terebra tristis* Deshayes.
**Turritella symmetrica* Hutton.
**Umbonium anguliferum* (Philippi).
**Venericardia lutea* (Hutton).
**Venericardia purpurata* Deshayes.
**Zenatia acinaces* (Quoy & Gaimard).
Myllita finlayi Marwick.

It is seen that of these 29 species 16 (55%) are Recent. While it is obviously unsafe to make any definite assertion as to age on the basis of a collection as small as the one here described, it would seem that the Ruakokopatuna beds occupy a position intermediate between Marshall's Waipipi and Target Gully Series. This correlation would make it of Waitotaran (Thomson 1920) age, which Thomson himself has stated to be probably Lower Pliocene..

GEOLOGICAL HISTORY.

Reference has already been made to the probable Trias-Jura age of the greywackes in this area. The marked regularity of the almost plane surface of these rocks, upon which the limestones rest, suggests at first sight two possible explanations as to the mode of formation, *viz.*:—

(1) A wave cut platform formed during the gradual advance of the sea over the land; (2) The peneplained surface of a former land area.

That the relatively plane surface of the truncated beds of the greywacke is not a wave-cut platform is attested by the absence of typical littoral deposits. The sequence of deposits overlying the greywacke commences with a glauconitic greensand. Glauconite is at present forming on the ocean floor for the most part in depths beyond the 100 fathom line and at a considerable distance from the shore. It would seem that the chief condition favourable to the formation of glauconite is that there should be only a small amount of terrigenous material in process of deposition. Such a condition may be realized in deep water comparatively close to shores where no rivers are present to convey their load of sediment to the sea. Furthermore, it would seem possible that glauconite might form even in relatively shallow water were the supply of detrital material not excessive. Such a relation between land and sea would exist where an old peneplained land was partly submerged. Transgression over such a land would be rapid though the amount of submergence might not be very great. Owing to the peneplained state of the still emergent land, terrigenous deposition would be almost absent, and the conditions perhaps not unfavourable to the formation of glauconite. It would seem that some such explanation as this is needed to account for the transition from what is apparently a peneplained land-surface to a deposit generally regarded as of deep-sea origin. It is certainly difficult to conceive of such sudden and catastrophic movements as would be required to convert a land-area immediately into one of deep submarine deposition.

The limestone immediately succeeding the greensand represents a deep-water phase. In its upper layers it shows, by the occurrence of a bed of shells cemented in a mudstone matrix, a return to shallow water. A considerable regression of the sea is proved by the occurrence of the blue and brown sandy beds. This regression was followed by a second transgression during which was deposited the Upper Shelly Limestone. There is little doubt that other beds, now removed by erosion, were deposited above this limestone. Such beds, in their final lithological and faunistic characters would no doubt exhibit a second and complete regression of the strand. Subsequent to the emergence of these Notocene deposits, block-faulting and tilting occurred, and in the fault-angles so formed these rocks have been preserved. From the remaining portions of this area of late Notocene deposition erosion has removed the relatively weak covering-strata. The later geological history of the area has already been dealt with in the section devoted to physiography and the evidence of recent uplift noted.

NEW SPECIES OF FOSSIL MOLLUSCA.

In the above lists of fossils collected four new species occur. These are:—

Modiolus n. sp.
Crassatellites n. sp.
Macrocallista n. sp.
Arca cottoni n. sp.

Of these, the first was collected from the Brown Sands, the other three from the Blue Sands.

Arca cottoni n. sp. (fig 1).

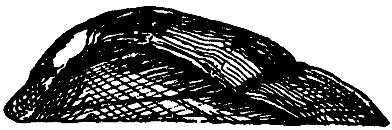
Shell elongately sub-rhomboidal inflated inequilateral, posterior slope strongly and sharply carinate. *Beaks* situated at about anterior fifth, distant, directed anteriorly. *Anterior end* short, rounded, posterior end larger. Dorsal margin between hinge-plate and posterior end angled, posterior margin very narrowly rounded and descending straight to basal margin. *Cardinal area* broad, long, carrying twelve broadly v-shaped ligamental striae. *Margins* crenate, *Hinge-plate* narrow in middle, widening a little at anterior end, more so at posterior end, straight. *Teeth* vertical below beaks, small, oblique, and larger at posterior end of plate. *Sculpture*, fine radial ribs on posterior slope becoming increasingly strong towards and on anterior slope; concentric growth-lines similarly weakly and strongly developed.

Length 37 mm.; height 13 mm.; diam. 22 mm.

Locality Blue Sands Ruakokopatuna River.

Holotype New Zealand Geological Survey Department.

a



b

FIG. 1.—*Arca cottoni* n. sp. Two views, *a* and *b*, of the same valve.

ACKNOWLEDGMENTS.

I am indebted to Mr. K. Graham, Chief Draughtsman of the Lands and Survey Department, for lending me the instruments for the Survey; to Dr. J. Marwick, of the Geological Survey Department for the identification of the molluscan fossils collected, and to Dr. J. A. Thomson of the Dominion Museum for the identification of the brachiopods.

LITERATURE CITED.

COTTON, C. A. (1922). *Geomorphology of New Zealand.*

GRABAU (1913). *Principles of Stratigraphy* pp. 723-45.

LAMPLUGH, C. (1920). *Quart. Journ. Geol. Soc.*, vol. 75, p. 249.

MARSHALL, P. (1919). Fauna of the Hampden Beds and Classification of the Oamaru System. *Trans. N.Z. Inst.*, vol. 51, pp. 226–50.

MARSHALL, P. (1912). New Zealand, *Handbuch der regionalen Geologie*, pp. 35–39.

MARSHALL P. and MURDOCH, R. (1920). Tertiary Rocks near Wanwanui. *Trans. N.Z Inst.*, vol. 52, pp. 115–128.

MURRAY, J. *Challenge Reports*, Deep Sea Deposits, pp. 382-85.

MCKAY, A. (1879). *Reports of Geological Explorations during 1878-79*, pp. 69–75.

THOMSON, J. A. (1916). On Stage Names applicable to the Tertiary in New Zealand, *Trans. N.Z. Inst.*, vol. 48, pp. 28–40.

Notes on the Glaciation of Ruapehu.

By Professor GRIFFITH TAYLOR, D.Sc.
(Communicated by Professor W. N. BENSON.)

Read before the Otago Institute, 8th December, 1925; received by Editor, 30th December, 1925; issued separately, 7th December, 1926.]

In January, 1923, I spent a few days on the slopes of Mt. Ruapehu, which we climbed on the 17th. I have been asked to write some account of my impressions of the glacial features noticed on our ascent.

Ruapehu rises "from a circular base of some forty miles in circumference to a summit [of 9175 feet] truncated by a crater nearly a mile across.... The summit-crater is almost filled with ice, which has used the hollow as a 'collecting-ground,' the excess overflowing the low parts of the crater-ring chiefly towards the east, while a part (of the ice) moves in the direction of a small hot lake in the middle of the crater, formed by the action of the escaping steam on the ice, the supply of water being constantly replenished by the melting of small icebergs which break away from the ice-front as it reaches the hot water."*

In the diagrammatic sketch (fig. 1), it will be seen that the cone rises rather rapidly from extensive tussock-plains situated at a level of about 3,500 feet above the sea.

A word or two as to the zones traversed in the ascent may be of interest. The first belt consists of forest growth, largely mountain beech, and is about one mile wide. Then a zone of rising moorland is crossed with heather and grasses, the path being marked by small cairns. Deep gullies are carved out of the soft volcanic debris on which flourished a few flowers.

At an elevation about 1,000 feet above the hut we came on an isolated block of lava about eight feet across, which stood out markedly on the relatively smooth slopes thereabouts. I show its approximate position on the sketch. It reminded me of many erratics I had seen in other regions, but no definite proof other than shape and position can be adduced. The absence of striae means little. In the Antarctic in 1911 we traversed 100 miles of country where ground-moraine was present for miles, and saw only one striated block. The same type of rock—a rather soft and coarse eruptive rock—is found in both regions.

About 5000 feet up great plains of pumice and silt show how intense is the erosion of the steep soft ashy material. These silts are especially noticeable above the great dyke called "Mead's Wall." The track vanishes now, as a belt of craggy lava and scoria

*R. Speight, "The Tongariro National Park," in *New Zealand Nature Notes*, a Handbook issued for the Wellington meeting of the Australasian Association for the Advancement of Science, January, 1923, p. 32.

is traversed which leads one up to the snowline—about 6,500 feet high in summer.

At this level conditions remind one of those at Kosciusko in New South Wales. Large snow-drifts occupy sheltered hollows, and strong streams descend from hollows at their lower ends. Here is a very interesting zone, where in my opinion undoubted glacial evidence exists. I was unable to obtain accurate levels, but I estimate the snout of the Whakapapa Glacier is at about 7,500 feet elevation. The slopes here consist of solid masses of basic tuff, or some similar rock, and one flattish area just to the north of the stream some fifty yards across, as far as I can remember, has a "plucked" appearance, as if a glacier had removed all loose material but had not proceeded so far as to smooth the surface. Hereabouts were a number of shallow grooves and many striae. We noted a rock seven feet across, with some striae on its faces, but I was not able to give up the time necessary for a complete examination.

The glacier snout is soon reached. It lies in a small valley about two hundred yards across, with lava walls rising forty or fifty feet above the present glacier. The cross section is not unlike the typical "catenary curve" of the glacial valley. The glacier, however, so far as we could see it, was covered deep with snow in its lower portion. In the upper portion I saw some areas of loose rounded agglomerates of a mixture of snow and ice, which approximated to névé. Of solid ice none was visible on our visit to the glacier proper. At the top, above the hot lake, there was a fine bergschrund below Paretetaitonga, and numerous crevasses around the lake.

Noteworthy features to the north of the lower glacier were several cirques (See fig. 1). In all probability these are being excavated by "thaw and freeze" processes at the present time. I do not think they indicate greater glaciation in the past, for their present site where, I imagine, a temperature of 32°F. is often experienced, is probably the optimum for nivation. This aspect is discussed in the writer's account of the cirques on Mt. Field.*

The whole glacial environment is to be compared with that of Mount Kosciusko, but here probably only intermittent cirque-cutting is proceeding, for there are no glaciers, and it is rarely that the drifts last the whole twelve months.

Keeping in mind the character of the rocks, one could not expect clear traces of ancient glaciation, for the later subaerial erosion is too intense. It would, however, be very surprising if the North Island had not experienced the general Pleistocene cooling. (One does not know, of course, how old is the cone of Ruapehu.) It is possible that on close examination glaciation may be found down to 4,500 feet. There is little doubt in my mind that not far back in geological time the glaciers extended a thousand feet below their present level.

*T. G. Taylor, "The Glaciation of Mount Field, Tasmania," *Proc. Royal Society, Tasmania*, 1922, pp. 193 ff.

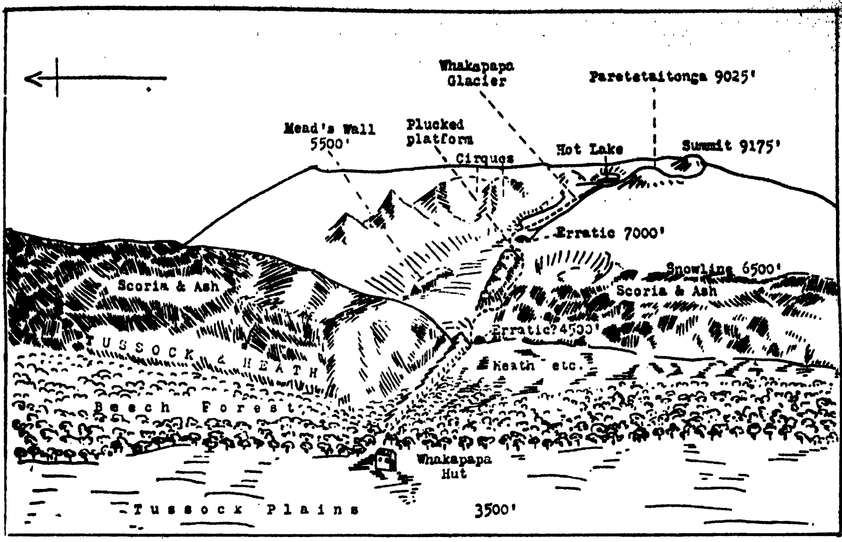


Fig. 1. A DIAGRAMMATIC SKETCH OF THE NORTHWEST SLOPE OF THE VOLCANIC RUAPEHU, NEW ZEALAND.
(The track shown is about six miles long).

The Origin of Lake Waikaremoana.

By P. MARSHALL, M.A., D.Sc., F.G.S. F.N.Z. Inst., Hutton and Hector Medallist of the New Zealand Institute

[*Read before the Wellington Philosophical Society, 12th August, 1925; received by Editor, 31st December, 1925; issued separately 7th December, 1926.*]

Lake Waikaremoana lies forty-eight miles north of Napier, close to the east side of the main divide of the North Island. Its area is 20.8 sq. m.; area of catchment basin 168 sq m.; approximate surface level 2,015 ft.; depth 848 ft.

The position and outlet of this lake are quite exceptional. In the first place its surface is at an unusually high level when compared with the altitudes of the surrounding country. In the area between the lake and the coast there are no hills with a greater height than 2500 ft. and in consequence a considerable sweep of sea coast 30 miles distant can be seen from the outlet itself. The extreme summits of the mountain range to the north-west are only 4500 ft. in height, and elsewhere the highest points are less than 4000 feet in altitude.

Immediately adjacent to the lake, and in fact the continuation of its outlet, is the valley of the Waikaretaheke River, which at a point not more than two miles distant is 1400 feet below the level of the lake. The barrier which holds the water of the lake back from the relatively low level of the valley is a most unusual feature.

In several places—not less than twelve—the water of the lake penetrates through this barrier and issues in streams of larger or smaller size from its outer slope. The various streams soon unite, and combined with the water from the surface outlet, constitute the Waikaretaheke River, which rushes down the steep slope of the barrier in a series of fierce cascades. During some months of the year the leakages through the barrier more than balance the inflow and no water then flows through the narrow channel of the outlet.

The escape of water through the leakages is of course nearly constant, and the narrow gorge of the outlet does not allow of a great increase of overflow as the level of the lake rises. Consequently in periods of heavy rainfall the inflow is much greater than the outflow, and for this reason the level of the lake is liable to greater variation than that of the majority of lakes.

The indented and irregular outline is also rather peculiar, and the ratio between the area of catchment and lake surface is rather small for a lake that occupies part of a valley-system formed by stream erosion. That this is the nature of the basin of Lake Waikaremoana is at once indicated by its outline, and by its relation to the physiography of the surrounding country. It is clear at a glance that the arms of the lake are merely drowned portions of existing stream valleys.

The rocks that occur in this locality are:—

(1) A sandstone of moderate hardness with its grains partly cemented together by carbonate of lime.

(2) A fine grained bluish-grey claystone or so-called papa. The rocks are arranged in well-defined strata which have a considerable uniformity over a wide area.

These strata strike 40° (magnetic) and have a dip of 18° to the south-east. All the prominent hills on the south side of the lake,—Puketapu 3905 ft., Pukanui, Panikiri and Ngamoko 3644 ft.,—are escarpments in a series of strong sandstone strata which are perhaps 900 feet thick.

The north-west slope of this escarpment in Panikiri has an angle of 78°, though the papa rock below the sandstone escarpment on the same slope has an angle of only 20° on the continuation of the same hillside. The south-east slope of these hills follows the surface of the harder sandstone with great regularity along the dip.

The outlet of the lake is situated at its south-east corner, and the direction of the stream that issues from it closely follows that of the dip of the rock.

The soundings made by Keith Lucas show that the slopes below the water-level of the lake are in general similar to those above it. This suggests that the slopes above and below the present water-level have been formed by the same agency—in other words the contours of the surface-relief acquired their present form before the waters of the lake occupied this area. The floor of the lake has a central relatively flat area about one square mile in extent. There are deep channels extending up each arm of the lake, and the most noticeable of these is in the direction of the outlet. Raekahu, the hill on the

south side of the outlet, is 2421 feet high, or 406 feet above the level of the lake surface. It is formed entirely of broken material which extends outwards on its south-east slope to 800 feet above sea-level or 1600 feet below the summit of the hill. The whole of this slope as well as that from the outlet to the valley of the Waikaretaheke is irregular and hummocky with large angular rocks showing frequently. There are many depressions in this irregular surface which are filled by the waters of small lakes.

The whole physiography shows that the structure of this barrier has been formed by agencies in which the ordinary action of running water took no part. Two agencies at once suggest themselves:—(1) Glacial action and (2) Earth-slides.

(1) Terminal moraines formed by glacial action have in many instances in New Zealand and elsewhere formed barriers across mountain valleys, and behind these morainic structures lakes have been formed when amelioration of the climate has caused the ice-masses to melt. The moraines piled across such valleys, however, constitute firm and impervious dams through which no percolation of water takes place. They have also a gently-sloping outer face, mainly formed of gravels carried by the streams that issued from the terminal face of the glacier. The crest of the barrier of Lake Waikaremoana is far narrower than that of a moraine. Again, a close examination of the rocks of which the Waikare barrier is formed shows that they are all of local origin,—there are no fragments of the rocks of which the north western margin of the catchment area is formed. Glacial action would certainly have carried a large quantity of such material to a terminal moraine. Finally there seems to be a total absence of flat-sided and striated boulders which are characteristic of material that has been deposited by glaciers. It is therefore apparent that this great barrier is not of a morainic nature and opinions in regard to its permanence that might be based upon this idea of its origin must be abandoned.

(2) The geological structure of the district is precisely that which most effectively promotes earth-slides of large dimensions. This structure is best exemplified in the hills Puketapu, Panikiri-Ngamoko. In each of these there is a hard cap of sandstone at least 700 feet thick resting on impervious relatively-soft papa which readily develops a greasy or unctuous surface. The dip of the whole series is 18° to the south-east, and is markedly uniform.

The prominent and dominating escarpment from Puketapu to Ngamoko is broken by the depression of the outlet at Onepoto. The strata of sandstone were of course at one time continuous between the outcrops on these hills, and probably the escarpment then extended with little interruption across this distance, though it would have been breached by a gorge through which the drainage of the Waikare basin passed. At the point of the breach through the line of the present escarpment the gorge of the river was certainly 1000 feet below the present lake-level. It has to be assumed that the "pre-lake" Waikare River in one of its meanders, or that one of its tributaries, had cut deeply into the sandstone at the low level of that valley some two miles below the present outlet. This erosion must

have been deep enough even to expose the papa below the sandstone (Fig. 1).

The heavy masses of thick sandstone would then have no support at the lower end of the dip-slope, and under a special association of extreme conditions would slip down the slope. If these conditions were so extreme as to enable the heavy rock-mass to acquire some velocity, its movements would be so great that it would smash and pile itself up even in such a mass as that of Raekahu—which though a prominent point is only 406 feet above the level of the lake and 1484 feet below the summit of Puketapu—the level from which it is conceivable that the material that travelled furthest was derived. This slipping rock would consist mainly of sandstone with sufficient papa to fill up the crevices between the rocks and make the whole mass watertight (Fig. 2).

It is probable that this slide filled the gorge of the pre-lake Waikare river to a partial extent only. Its effect would be the formation of a small lake, and it would also force the current of the outflowing river further east, where it would undermine the escarpment then lying north-east of the present outlet. Deposition in the basin of the small lake thus formed might be the origin of the flat central floor of the lake.

The erosive effect forced thus to the north-east by the slipped matter in time rendered the escarpment in that direction insecure, and a second slide took place, for the kind of rock and geological structure are the same here as on the south-west side of the outlet (Fig. 3).

This second earth-slide from the eastern side was, however, of less amount, and the movement was not so great. The rock-masses on this side have been far less smashed and piled up. It still retains something of its original form and structure. This second slide-movement consisted almost solely of the sandstone strata, and started from that portion of the escarpment north-east of Rosie Bay, which actually owes its formation to this movement. The measure of the horizontal component of this movement is to be found in the distance between the summits of the two ridges on either side of Rosie Bay—perhaps rather more that 400 yards. The hill to the south-west of this bay has an escarpment of rock-masses fractured and tumbled in a most remarkable manner, but still all the masses clearly form parts of a former continuous escarpment. The absence of slipped papa, at any rate in the upper part of this slide, renders it less obstructive to the passage of water, which therefore penetrates to a large extent between the fragments of the rock-slide, and issues as leakages at various points over the outer slope of the barrier to a level of 300 feet below the lake surface.

If this explanation is correct it follows that the subterranean channels through which the water passes are of a highly indefinite and irregular nature, and that it is impossible from any examination of the surface to form any reliable idea of their intricacies or the details of their directions. The nature of the ground also shows that the width of these crevices depends on the relative position of various angular rocks which may be more or less unstable, though if it be

correct that in this rock-slide the movement was relatively small and the rock travelled "en masse" and without much crushing, it is probable that the blocks are well keyed-in and fairly stable. That this rock has travelled from a higher level is shown by its nature. Near the outlet the broken rock contains seams which have fossil polyzoa which appear to me to be restricted to the higher strata of the sandstone.

The actual outlet passes through the second slip very close to its south-west margin where it abuts against the material of the first slip.

It is probable that if the excess of rainfall over the evaporation amounts to 60 inches annually over the catchment area, that about ten years would elapse before the basin would be filled. Within that time some consolidation of the slipped matter might have taken place, and some stability of the barrier would have been attained. It is noticeable that the overflowing water at the outlet escapes by one of the fissures that has been formed in the slipped rock of the second period; for in my opinion the overflowing water has not had any appreciable erosive effect on the rock which forms the lip of the lake at the outlet.

The question at once arises of the stability and security of the upper portion of this naturally-formed dam. It must be recognised that in a geological sense this barrier is only a temporary feature of the physiography. In time the outflow will corrode its channel in the loose debris, and ultimately will completely drain the lake.

In forming an opinion as to the stability of the barrier the following matters must be considered.

1. The structure of the dam. 2. The age of the dam. 3. Its stability in the past. 4. The leakages. 5. Erosion by the cascades. 6. Heavy rainfall. 7. Chances of further landslides.

1. *The structure of the dam.*—As already stated, that portion of the dam which was formed by the first landslide (*i.e.*, on the south side) appears to be almost impervious, and quite secure. On the other hand the portion that lies to the north-east of the outlet, which was due to the second landslide, is formed of far larger and more solid blocks of rocks, but between these there are numerous crevices. Along these water flows and issues as leakages on the outer side of the barrier in at least twelve places. This implies a loose setting of the rocks and a condition of relative instability, the absolute amount of which cannot be stated with any certainty.

2. *The age of the dam.*—Information in regard to the age may be obtained by observations made on the following:—

(a) The distribution of the pumice covering of the ground; (b) The size and extent of the wave platforms on the lake shores; (c) The nature of the lake beaches; (d) The amount of erosion by the stream which runs over the barrier.

(a) It is noticeable that the distribution of pumice is general, and as uniform as could be expected over the whole of the slipped material. This fact indicates clearly enough that the earth-slides occurred before the great fall of pumice in this district. This cer-

tainly took place before the occupation of the land by the Polynesian people. It is probable that the fall took place several thousand years ago. This, from the human standpoint, gives a great antiquity to the barrier.

(b) The wave-platforms on the lake-shores are of small dimensions. They occur only in those localities where soft papa rock constitutes the lake-shore. These ridges of soft rock are worn back into truncated spurs. In such places a wave-platform not more than 20 yards wide in any observed cases has been formed. Where sandstone forms the lake margin no platform whatever has been formed, nor does the sandstone appear to be waterworn. These observations indicate that from the geological standpoint the water of the lake has been at the present level for an extremely brief period.

(c) It is said that on the beach-shores sand is to be found at Onepoto only. The sand that lies on the beach at this place consists of angular quartz grains and crystals of hypersthene; substances that are clearly derived from pumice. The presence of this sand does not, therefore, suggest that wave-action has taken place for any but a very brief period. The absence of sand elsewhere goes far in support of this conclusion. Generally speaking there are no beaches on the sandstone frontages of the lake, and it is also noticeable that the small rock-fragments have not been appreciably worn by wave-action. In the lee side of the head-lands formed of papa small beaches have been built up. There are also flats formed of detrital matter in those places where small streams enter the lake. All of these that were seen are however quite small when the softness and rapid yield of the papa to erosion are considered.

(d) Erosion of the outlet: It is a well-known fact that lake-water erodes a channel through rock very slowly. There is an absence of suspended matter which is the most effective tool in the ordinary course of erosions by running water. As previously stated the actual outlet of the lake passes through a rift which has not been formed by erosion.

3. *The stability of the dam.*—It is of course recognised that such a structure as this dam, narrow and composed of loose incoherent material, cannot in the nature of things have a long life from the geological standpoint. The present question however is whether reliance can be placed on the dam to contain the water of the lake permanently from the human standpoint.

It must first be considered whether the dam has suffered any partial collapse since its formation.

Evidence has to be sought on the lake shores. The existence of terraces round the lake above the present water-level would at once indicate that the dam had partly failed at some time in the past. Search, however, failed to trace any terraces. At the boat-landing at the Accommodation House there is an alluvial flat at a level that is seldom reached by the lake-water. It is, however, quite possible that this could be formed at the present time, for as has been previously stated, the gorge-like form of the narrow outlet causes the level of the water to vary more than is usually the case in lakes.

4. *The Leakages.*—At the present time the water-escape from the lake mainly issues from leakages which are the terminal points of subterranean channels. There are at least twelve of these, from some of which a large volume of water issues. These are situated at relatively high levels—within about 300 feet of the present lake-level. They are found at various places between the base of Raekahu and the second valley east of the outlet, a distance of about 600 yds.

At the mouth of these leakages the water is seen to issue from crevices between loosely-packed angular boulders of large size. All of these leakages appeared to be long established, and no evidence was found of a leakage having increased or decreased in amount, though there are spots now dry from which it seems that water has issued in the past. It is a curious fact that the escape of water through leakages so nearly balances the inflow into the lake as to maintain the surface-water at about the same level for such a long time as to allow of the formation of a moderate wave platform in the papa rock.

5. *The erosion of the barrier.*—As stated earlier the stream at the outlet has little or no erosive power, but the rush of water is so violent on the steep outer slope of the barrier that small rock particles are soon gathered and the small boulders are from time to time rolled over, and at a distance of 300 feet below the lake level on the outer side of the barrier the erosion becomes important. The chemical erosion is small, since very few of the boulders contain carbonate of lime in important amount. Thus it is probable that the leakage-channels and outlet-rift are likely to remain of practically constant size.

6. *Heavy Rainfall.*—If it is admitted that the main cause of weakening of the barrier is the mechanical erosion of the outflowing stream at some distance below the lake-level, it follows that whenever this action is at its maximum the weakening is greatest. This of course occurs in a period of maximum rainfall, for at such a time not only is the rush of water greater, but there is a greater supply of detritus from the surface of the barrier—the most efficient tool for erosion—and at the same time the cohesion of the surface material is reduced.

There is, however, no indication that at a moment of maximum weakening there is any danger of the lake-waters breaking through at present.

CONCLUSION.

When all these matters are taken into consideration it may be said:—

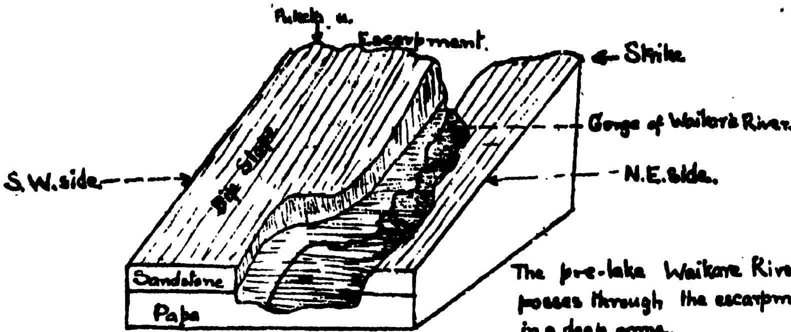
1. That outlet passes over and through a mass of fractured and tumbled rocks, which are angular and are probably interlocked in an intricate manner, and possibly the whole mass has no great margin of strength compared with the forces which are acting on it.

2. The leakages through this mass have maintained a constant flow for a long period.

3. The leakages are not materially decreasing the strength of the barrier.

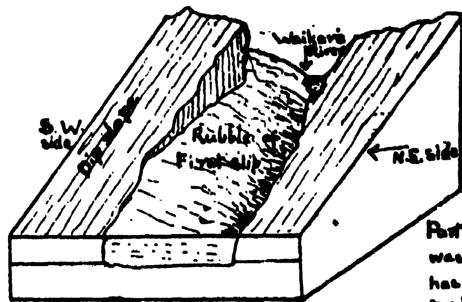
4. The surface cascade over which the water of the outlet and leakages combined pass is slowly reducing the resistance and stability of the barrier.

No important slide-movement of the rocks on either side of the dam is to be apprehended.



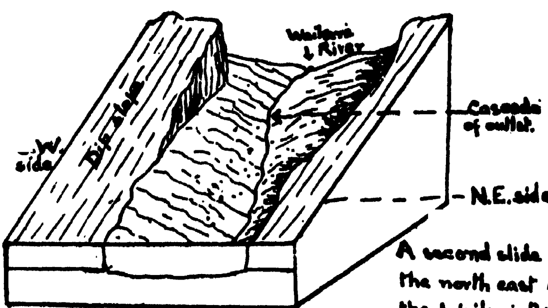
The pre-lake Waikare River passes through the escarpment in a deep gorge.

Fig. 1.



Part of the escarpment south west of the has slid into it, and has forced the stream to the north east.

Fig. 2



A second slide has moved from the north east and has forced the Waikare River back to the south west slightly

Fig. 2.

The Western Coast of the Firth of Thames.

By J. A. BARTRUM.
Auckland University College.

[*Read before the Third Science Congress of the New Zealand Institute, Dunedin, 28th January, 1926; received by Editor, 9th February, 1926; issued separately, 7th December, 1926.*]

The writer recently travelled from Clevedon, a township situated at the upper tidal limits of Wairoa River, which flows into the enclosed harbour waters south of Waiheke Island near Auckland, eastwards by road to the west shore of the Firth of Thames and then south along that shore to New Brighton. From this point almost to the head of the Firth there is a sweeping shell beach backed inland for some five or six miles further south as far as Miranda by wide swampy flats.

From New Brighton return was made by way of a road which, after crossing the main divide, follows down the broad valley of the middle portion of the Mangatangi Stream until it joins the Miranda-Pokeno road.

Although the area of which a glimpse was thus obtained is correctly shewn on geological maps of New Zealand as constituted by greywackes and associated sediments now assigned to the Hokonui System of Trias-Jura age, the writer has been unable to find any descriptive account of its geology or any reference implying knowledge of certain interesting features it possesses.

FAULT SYSTEMS OF THE AREA.

In conjunction with Mr. C. R. Laws the writer recently closely studied an area between Papakura and Hunua west of that shewn on the present map, and found that there are two systems of faults blocking out the district, and that these are the same as those recently mapped by Henderson (1924a) which originate in the central or Taupo region of the North Island. Their directions in the present area are respectively approximately N.E.–S.W. and N.W.–S.E.

It will be remembered that N.N.W.–S.S.E. faults are believed to be responsible for the development of the graben-like depression occupied by the Firth of Thames and the Hauraki Plains, and that the existence of a great fracture on its eastern margin has long been clearly demonstrated. On its western margin, however, the evidence so far adduced has not been at all conclusive, apparently on account of inadequate knowledge of the west coast of the Firth of Thames; for, in actual fact, this coast furnishes topographic and other evidence so indicative of the presence of a great fracture that its existence can scarcely be questioned.

Another member of this N.W.–S.E. system of faults follows the middle course of Wairoa River and then, after crossing the lowlands connecting Papakura with Clevedon, which are themselves the filling of a fault-angle depression due to a fracture of the N.E.–S.W. series, is traceable by means of a very distinct fault and fault-line scarp

north-west towards the Waikohu Estuary on the outer harbour coast east of Auckland.

The N.E.–S.W. fault responsible for the Papakura-Clevedon depression has been named the Papakura Valley fault*; it is marked by an unmistakeable fault-scarp on the north-west border of the depression towards which the earth-block represented by the Hunua Range is sharply tilted. At Clevedon the fracture appears to bend more to the north and thence to follow closely the coast trending north from the mouth of Wairoa River.

A most instructive idea of the structure of the area shewn in the accompanying map can be obtained from distant points such as Waiheke Island or Motutapu. There are two erosion levels clearly recognizable in relics constituting broad flat interfluves, which are seen to rise successively in steps from south-west to north-east above the lowlands bordering adjacent arms of the Manukau Harbour.

The first of these levels is constituted by the area west of the Wairoa River fault, and the second by the elevated block north-east of the middle course of the Wairoa, which has especially well-preserved plain-remnants at a maximum elevation of between 1,300 ft. and 1500 ft. This latter block, in common with neighbouring earth-blocks, appears to have a tilt towards the north-west; its back-slope on the south-east is deeply eroded by the Waiora, Mangatawhiri, Mangatangi and other streams, and the topography suggests strongly that there is considerable relative downthrow of the area south-east of this slope along a N.E.–S.W. fault which passes to the Firth of Thames near New Brighton.

Study of the map will shew that the elevation called Kohukohunui (2,145 ft.) rises very definitely as an elongated dome above the 1,300 ft. to 1,500 ft. erosion surface just mentioned; the disparity of heights is very striking in distant views, and it is not improbable that Kohukohunui represents a block elevated above that west of it along a N.W.–S.E. fracture. Such a fracture may well have topographic expression in the broad straight valley of the middle portion of Mangatangi Stream. On the eastern flank of Kohukohunui there is a particularly rapid descent to coastal lowlands built in part of fan-débris, and for many miles this steep slope is an almost rectilinear scarp which, in conjunction with the presence of hot springs at Miranda, is strong evidence in support of the existence of a faulted western margin to the Hauraki depression, as was surmised by Lindgren (1905) when he termed this latter a graben. Though failing to find evidence of this western fault in the Aroha Subdivision, Henderson (1913, p. 51) accepted Lindgren's views as to its presence and gave it the name of the Miranda Fault. He further pointed out that in all probability it actually is a fault-complex and not a simple fracture.

Terraces near Clevedon.

The Wairoa River is entrenching itself near Clevedon township in a small flood-plain carved in resistant greywacke at a height of a few feet above stream level. Nearby there rise two flights of very

*Laws, C. R., and Bartrum, J. A., The Geology of the Papakura–Hunua Area. M.S. in possession of Auckland University College.

prominent terraces with regularity of surface which is suggestive of genetic relations to earlier sea-level. The lower terrace rises about 35 ft. and the upper approximately 80 ft. to 100 ft. above sea-level. The lower continues north on the west bank of the Wairoa River and also extends as a great plain in the Clevedon-Papakura lowland, but is not at all prominent east of Wairoa River, though there are extensive terraces of about equal elevation a little north of New Brighton. The 80 ft. to 100 ft. terrace, on the other hand, has important development only east of the Wairoa River. A short distance north-east of Clevedon it encircles in interesting manner an island of more ancient greywacke 278 ft. high, on the summit of which is trig. station 646. As will shortly be shewn, the terraces are built of material deposited from still waters, so that depression, which caused the submergence of valleys substantially the same as the present ones of the Wairoa, Ness and adjacent streams, began before and, as we shall see later, continued during the building of the terraces.

The lower or 35 ft. terrace appears to have been carved by the Wairoa and other streams, but the higher one skirts around the ends of divides separating adjacent streams and so passes from the Wairoa into the Ness valley. The road from Clevedon follows close to the northern margin of this terrace, which is succeeded seawards by an extensive modern delta-flat built in the enclosed sea-waters by the Wairoa and Ness Streams. Near the mouth of the Wairoa estuary, however, an island of greywacke rises prominently above the low surface of the delta and the adjacent sea.

In such exposures as were examined the material of the terraces was found to be a fine-grained pumice-silt in which there are occasional beds of fine pumice-conglomerate with pebbles about ¼ inch in diameter. Near the bridge over the lower Ness Stream, the silt is laminated in a manner exactly reminiscent of varve shales; the laminae separate readily one from another and yield impressions of leaves and other plant-remains. It is obvious that the material has been deposited in very sheltered still water. Near Papakura there are similar deposits of pumice-silt, though they do not rise so high above sea-level, and it is probable that similar silts underlie the sub-recent swamps and buried forests of the Papakura-Clevedon depression. The south-eastern fringes of the lowlands of that area, which rise considerably above the swamps, are carved, however, in soft Tertiary (Papakura Series) sandstones.

At Kawakawa Bay east of Clevedon, the higher terraces, though inextensive, are distinctly exhibited, whilst a succession of small terraces, the lowest of beach-gravels and only a few feet above storm-beach level, and the highest about 30 ft. above sea-level, are eroded in the delta-gravels of a small stream entering the bay.

TERRACES OF ORERE STREAM AND OF THE ADJACENT WESTERN COAST OF FIRTH OF THAMES.

Seawards from its confluence with Paratahi Stream, Orere Stream exhibits in its valley several flights of terraces. One of the most persistent is a gravel-built bench rising about 30 feet above the gravel-strewn bed of the entrenched swift-flowing stream. Slightly above

this there are occasional cuspate remnants of terraces and then at the distance of about three miles from the sea, there begins an abrupt rise to the top of an extensive ancient plain, approximately 135 ft. above sea-level near the shore, but rising gently inland, which spreads out in delta-fashion at the mouth of the stream. At the shore-line the sea-cliffs yield a splendid section of this lofty terrace. At the base there is a strongly cemented coarse conglomerate exposed for a depth of 25 ft. and passing down below sea-level, which is made of considerably-weathered pebbles of greywacke averaging 2 ins. or 3 ins. in diameter. The shape of the pebbles shews that they are ancient alluvial fan-gravels, and further evidence of such origin exists in the presence of intercalated thin discontinuous lensoid beds of mudstone or shale, which, with certain layers rich in altered vegetation, including small trees in the position of growth, evidently represent the filling of sheltered pools. Next above the gravels there are very fine-grained whitish pumice silts and greyish muds bedded horizontally and containing many carbonaceous bands rich in plant-remains, some of which are partially carbonised and some not. One such band in particular contains stumps of trees six inches and more in diameter, with horizontal radial roots exactly in the position of growth.

Above the silts and muds there are further coarse conglomerates about 30 ft. in depth where exposed in the sea-cliffs, but doubtless increasing in thickness inland. As with the lower conglomerate the material appears to be wholly greywacke with argillite and allied sedimentary facies derived from Hokonuï strata; it is very firmly consolidated and shews fairly general weathering, so that locally it is converted wholly to blotchy clays.

About half a mile or more south of Orere Stream the lower conglomerate locally contains abundant concretionary spherules of vivianite which have crystallized in radial fibres in the interstices between the pebbles.

At the mouth of Tapakanga Stream, the first important stream south of Orere Stream, there is reappearance of the 35 ft. terraces. These are carved in very pure relatively compact pumice-silt which is capped by a thin veneer of stream-gravels spread out like an alluvial fan. Shortly, however, these terraces are interrupted by a tongue of greywacke pushing out to form the sea-cliffs for perhaps half or three-quarters of a mile, but beyond this they reappear at Waimangu Stream, where they form a distinct salient of the coast. Near their seaward margin they are approximately 35 feet above sea-level, but this height increases upstream towards the head of the ancient alluvial fan. Below their surface the Waïmangu Stream has cut down a narrow valley with flights of small terraces on its sides.

Terraces of similar height have very extensive development several miles further south, though it was not ascertained whether or not pumice silts underlie the surface gravels. They have been considerably dissected by streams which, like the Waimangu, have often developed flights of terraces in the somewhat flaring valleys carved in their material. From the westward margin of this extensive zone of terraces the mountain slopes rise steeply in the scarp of the earlier-mentioned Miranda fault. Seaward there are either

low sea-cliffs now more or less protected by a fairly broad beach of cobbles as at the mouth of Waimangu Stream, or else, as is more general, there are forelands built almost wholly of a succession of cobble-beaches, although here and there, as near Colonel Adams's property, small streams have infilled lagoons enclosed behind cobble loops. No fewer than five or six successive beach-ridges can be counted on parts of the extensive foreland crossed by the Waihopuhopu, Puwhenua, and neighbouring streams; it is difficult without accurate means of obtaining heights to be sure if the earlier of these are or are not substantially above the level of the modern storm-beach, though they appear to be so. At Waihihi, however, there are remnants of beaches uplifted at least five or six feet, whilst near Ohinemahoi a low sea-cliff now retrogressing under wave-attack shews a beach-deposit of typical lensoid pebbles resting at a height of six or seven feet above the highest cobbles of the modern beach upon a platform of greywacke.

A glance at the map shews how considerable is the progradation of the shore-line near and north of New Brighton; its explanation is to be found in the abundant supply of pebbles and boulders of greywacke by wave-erosion on sea-cliffs of greywacke further north and by vigorous streams draining the western mountain slopes. Near the mouth of Orere Stream the supply must be especially abundant, since the Orere is a particularly vigorous stream and, in addition, destruction of the conglomerates in the sea-cliffs must yield plentiful pebbles and boulders.

ORIGIN OF THE TERRACES AND HISTORY OF THE AREA.

In a recent paper on the post-Tertiary history of New Zealand Dr. J. Henderson has summarized our knowledge regarding evidences of uplift gained from elevated wave-cut benches and other coastal terraces, and has attempted the almost impossible task of evolving order out of a chaotic list of facts. The Tertiary closed with the earth-movements of the Kaikoura orogeny (Cotton, 1916) which dislocated the Hokonui (Trias-Jura) strata and their covering of younger rocks along fault-lines such as those traced in this paper. Henderson (1924b) shews how the land was at one time 1000 ft. or more higher than now, but was later depressed until the old strand-line was submerged to 1000 ft. or more below its present level. The elevation began during what he calls younger Pleistocene time, and "high-level terraces bordering river-valleys, and littoral deposits forming coastal platforms or veneering wave-cut benches" were brought into existence. A general movement of elevation continued until the land was several hundred feet higher than now, but was succeeded by depression which raised the strand-line about 120 ft. above that of to-day and so developed a very persistent erosion and deposition-level at that height.

The last considerable movement he believes to have been an uplift bringing such terraces to their present elevation.

There can be no denial of the fact that oscillations of level have occurred which roughly have the order set forth by Dr. Henderson, but analysis of evidence from different areas leads to apparent contradictions, which may be illustrated by citation of the apparent

order of events in the vicinity of Auckland, disregarding vulcanism. A prolonged post-Miocene period of erosion with ensuing interrupted uplift, led to the development of a broad peneplain, now a dissected upland, with two lesser erosion-levels at about 90 ft. to 100 ft. and 25 ft. to 35 ft. or more respectively.

A sharp uplift, probably in the vicinity of 200 ft. in amount, caused the reinvigorated streams to entrench themselves in their flood-plains where these had been carved or built, but was shortly followed by a widespread probably eustatic movement of depression which gave rise to the submergence of coastal lowlands and to the embayed coastlines characteristic of so many of the harbours of North Auckland, and which quantitatively seems to have been nearly equal in amount to the preceding uplift. Since then there has been sub-recent minor uplift testified to by raised beaches and wave-cut benches in numerous localities.

The explanation of these apparent inconsistencies in the evidence perhaps lies partly in errors of interpretation, yet it is more probable that it is in the fact that the full history of any area is likely to be more complicated than we realize. Further, it must not be forgotten that the differential movements of fault-blocks by which New Zealand reached approximately its modern outlines during the Kaikoura orogeny may have continued practically to sub-recent times; the coastal outlines of adjacent blocks could then expectably shew very different sequences of events except in so far as they were affected by movements of a eustatic character.

The higher terraces of approximately 135 ft. in height on the west coast of the Firth of Thames are related to those about 150 ft. in height on the other side of the Firth near Thames, which have been recorded by McKay (1897) and Fraser (1910), but supply greater detail of their history than these latter. The evidence points to the probability that their building began when movement along the bounding faults of the Hauraki graben had caused the elevation of the land-mass west of the present Firth of Thames relative to that now submerged beneath this latter embayment.

Swift streams spread fans of gravels at the base of the developing fault-scarp and these have been consolidated to form the lower conglomerate at Orere. Shortly, however, a somewhat intermittent slow general submergence began, whilst differential movement of adjacent blocks temporarily ceased, so that the supply of fan-gravels was suspended and instead there was the building in sheltered waters of the delta of some large river—the Waikato in one of its early phases—which brought pumice from the central volcanic area near Taupo. The pumice-silts and the mudstones of Orere represent the topset beds of such a delta which increased in thickness as sea-level gradually rose. Between the Arapuni and Maungatautari gorges of the Waikato River, Henderson (1918, p. 58) has described deposits ascribable to the Waikato during this early phase, and even enclosing buried forests which have recently been disclosed in excavations for a deviation-channel in connection with the power scheme at Arapuni, and which indicate temporary cessation in deposition in conformity with the evidence at Orere. From

the gorge at Arapuni the early course of the Waikato followed north down the Hinuera Valley (Cussen, 1888; 1894) into what are now the valleys of the Piako and Waihou Rivers, where the river laid down deposits of which remnants exist in moderately well consolidated beds of pumiceous and other débris constituting the downs west of the railway at Walton and Waharoa. These beds, thus, must presumably be correlated with those at Orere and mark the deposits of a period when the strand-line, at the time of the maximum subsidence, was at least 100 ft. higher than now; their extent must have been very great, for they seem to have occupied almost the whole of the Firth of Thames south of the mouth of Wairoa River.

Whilst recognising the fact that his evidence is far from conclusive, the writer would hesitate to synchronise this period of negative movement of the land with the period of depression given by Henderson (loc. cit.) as the penultimate diastrophic movement of post-Tertiary time. He would suggest that, in conformity with the course of events at Auckland, after the deposition of the beds of pumiceous débris, an uplift took place which raised them well above their present levels, and which enabled the rejuvenated rivers to remove the greater part of these deposits.

Close upon this there followed widespread depression of the land which had as its result the embayed coast-lines of Auckland, and which caused an advance of the waters of the Firth of Thames far south of their present southern shores.

It is difficult to understand how, under the conditions of level of land and sea that obtain to-day, the removal of such vast quantities of earlier deposits, as undoubtedly have been removed, could have been effected. The very fact that the sub-recent and modern delta of the Piako, Waihou, and other streams has advanced 18 miles from former beaches at Maukoro, shews that such removal could not have occurred unless the erosive processes were stimulated by uplift. A further argument in favour of regarding the terrace-deposits as more ancient than those laid down during the last period of depression is based on the degree of consolidation and of weathering of the conglomerates at Orere. All deposits known definitely to have accumulated since this last submergence began are poorly consolidated and practically unweathered.

The presence of a conglomerate composed of coarse stream-gravels above the pumiceous silts and muds near the mouth of Orere Stream has yet to be explained, and implies a return of conditions similar to those which previously allowed the building of the lower conglomerate. Presumably there was renewed uplift of the earth-block west of Miranda fault with reference to that east of it at the conclusion of the period of subsidence already discussed. The differential uplift cannot have continued long, for general uplift of the whole region commenced after a comparatively small depth of fan-gravels had been deposited by streams upon the earlier silts and muds. This uplift was shortly interrupted for a sufficiently long period to permit the development of the extensive series of terraces here called the 35 ft. terraces, and was then continued until these latter stood far higher than at present, as has already been suggested.

So far as the writer is aware there are no accumulations of pumiceous material in the Lower Waikato—Manukau Harbour area reaching so high an elevation as the surface of the high-level terraces (80 ft. to 100 ft.) near Clevedon and at Kawakawa Bay, so that deposition of the material of these terraces probably was synchronous with that of the Orere Terraces. The pumice-silts of the Lower Waikato—Manukau area, on the other hand, are later deposits which were laid down in an estuary formed at the mouth of the Waikato River after it had been diverted to the west from its earlier course by way of Hinuera Valley to the Firth of Thames.

Igneous Intrusions in the Hokonui Sediments.

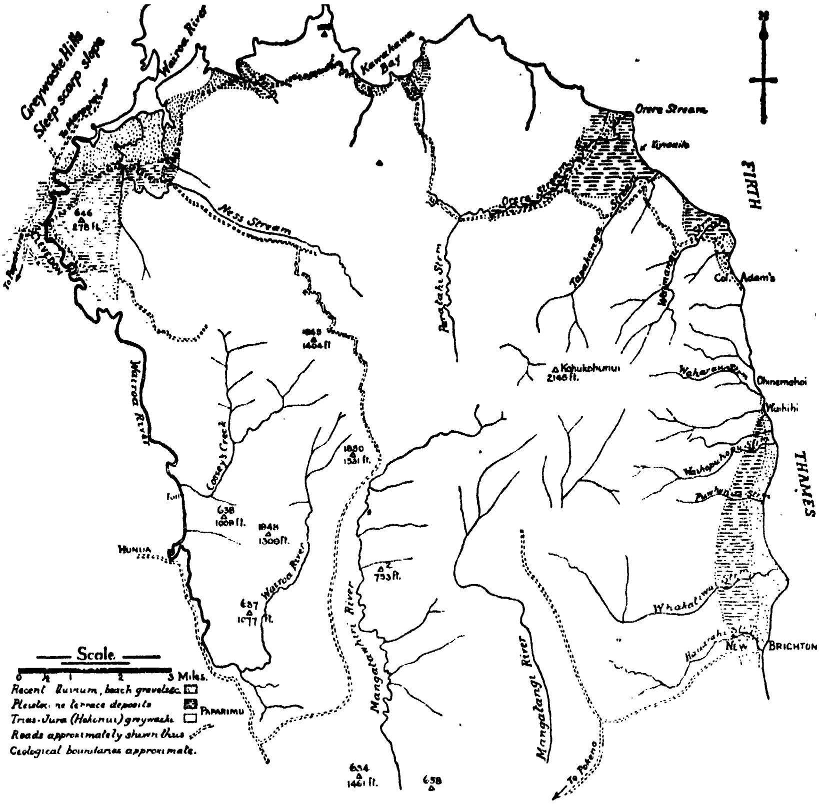
A careful search was maintained in the gravels of streams, draining the greywacke terrain of the area described in this paper for pebbles of igneous rock, but none were found apart from basaltic ones in the gravels of Wairoa River which intersects basaltic flows giving rise to the falls near Hunua. On the shore of Kawakawa Bay, however, near where the road from Clevedon comes to the beach, there are about twenty large scattered masses up to 3 ft. and more in diameter of an andesitic rock, which have probably been shed from some intrusion which the writer was not able to locate in the short time at his disposal.

The rock itself is a strongly porphyritic hyalopilitic pyroxene andesite, with very abundant plagioclase (acid labradorite) in both generations and a small amount of glass in the groundmass. The pyroxene is chiefly in phenocrysts and includes both augite and hypersthene.

Contrary to their abundance at Coromandel Peninsula, Whangarei Heads, and Great Barrier Island, intrusions of igneous rock are rare in the sediments of the Hokonui System nearest to Auckland. Besides the present example the writer knows of only one other, namely an outcrop of what appears macroscopically to be a porphyrite, which forms a knoll near Cowes Bay at the east end of Waiheke Island.

Conclusion.

The western coast of the Firth of Thames is defined by a fault (the Miranda fault of Henderson) which forms the western boundary of the Hauraki graben. On the east of the fault-line there is a discontinuous zone of uplifted ancient gravels and fine-grained pumiceous sediments representing early deposits upon the floor of the graben, which are now raised into conspicuous terraces fringed along a considerable portion of their seaward margin by beach-ridges and other deposits characteristic of a prograded shore-line. The pumice is believed to have been transported by the Waikato River when the latter followed an earlier course down the Hinuera Valley into the Hauraki graben, and an attempt has been made to trace the succession of diastrophic events by which the development of the topography of the area under consideration has been controlled. High-level terraces at Kawakawa Bay and near Clevedon are considered to have been built, like those east of the Miranda fault, during the period prior to the diversion of the Waikato River to its present course.



Map of an area west of the Firth of Thames shewing the Distribution of Post-Tertiary Sediments.

LIST OF PAPERS REFERRED TO

COTTON, C. A., 1916. The Structure and Later Geological History of New Zealand. *Geol. Mag.* (n.s.), dec. 6, vol. 3, pp. 243–249 and 314–320.

CUSSEN, L., 1889. Notes on the Waikato River-Basins. *Trans. N.Z. Inst.*, vol. 21, pp. 406–416.

———1894. Notes on the Piako and Waikato River-Basins. *Trans. N.Z. Inst.*, vol. 26, pp. 398–407.

FRASER, C., 1910. The Geology of the Thames Subdivision. *N.Z. Geol. Surv. Bull.*, No. 10 (n.s.).

HENDERSON, J., and BARTRUM, J. A., 1913. The Geology of the Aroha Subdivision. *N.Z. Geol. Surv. Bull.* No. 16 (n.s.).

HENDERSON, J., 1918. Notes on the Geology of the Waikato Valley near Maungatautari. *N.Z. Journ. Sc. & Techn.*, vol. 1, pp. 56–60.

———1924(a). The Structure of the Taupo–Rotorua Region. *N.Z. Journ. Sc. & Techn.*, vol. 6, pp. 270–274.

———1924(b). The Post-Tertiary History of New Zealand. *Trans. N.Z. Inst.*, vol. 55, pp. 580–599.

LINDGREN, W., 1905. The Hauraki Goldfield, New Zealand. *Eng. & Min. Journ.*, New York, 2nd Feb. See also *N.Z. Mines Record*, vol. 8, p. 370.

MCKAY, A., 1897. Report on the Geology of the Cape Colville Peninsula, Auckland, *N.Z. Parliam. Paper* C.—9.

Igneous Rocks from Western Samoa.

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[*Read before the Third Science Congress of the New Zealand Institute, Dunedin, 28th January, 1926; received by Editor, 29th February, 1926; issued separately, 7th December, 1926.*]

In 1920 Dr. J. A. Thomson, Director of the Dominion Museum, collected a number of igneous rocks from various parts of Western Samoa, and very kindly forwarded about thirty-four thin slices cut from these rocks, and from others collected by Mr. F. Wood in 1915, to the writer for description. From one cause or another the work has been unavoidably delayed, but this delay has proved to be an advantage in that a very interesting and instructive account of the geology of American Samoa by Professor R. A. Daly (1924) has been published since study of the collection was begun.

The writer is greatly indebted to Dr. Thomson for his courtesy in allowing him to describe this Samoan collection, and for arranging with the Dominion Laboratory for analysis of four of the rocks. Mr. F. T. Seelye, who undertook the analyses, has also very kindly furnished the norms and classification of the rocks. Thanks are due also to Dr. P. Marshall and Professors C. A. Cotton and R. Speight for the loan of Samoan literature not available in Auckland.

The collection does not include any rocks that shew outstanding difference from those previously described from Samoa. On the whole there is surprising uniformity of type. The great majority of the slides represent olivine-rich basalts, but there is every gradation from picritic and possible limburgitic basalts to types with relatively little olivine but plentiful plagioclase (generally acid labradorite), which chemically approach the border-line between basalts and andesites. There is far less variety of type than has been described by Daly (1924) from American Samoa. The only rock not belonging to the basalt series is a soda-trachyte collected from beach boulders at Masina, Fangaloa Bay, Upolu Is.

Since so little fresh information has been added by the present study, any very detailed description of individual rocks would be out of place, and has not been attempted..

General Account of the Basalts.

All of the basaltic rocks are very closely-related members of a series readily derivable by minor differentiation from a single magmatic intrusion. The more basic types include rocks closely allied to the picritic basalts described by Cross (1915) and Washington (1923) from Hawaii. Unfortunately one of the two analyses made of representatives of these picrite basalts is somewhat vitiated by the presence of a comparatively large amount of calcite filling vesicles of the rock. The majority of the rocks are olivine basalts in which plagioclase is not prominent, but, by increase in the amount of this latter mineral, these gradually pass into types in which

plagioclase is abundant. These plagioclase-rich basalts are not, however, nearly as well represented in the present collection as in that of Friedlaender described by Weber (1909).

The basalts typically are strongly porphyritic; the phenocrystic minerals are characteristically olivine and pyroxene, to which must be added plagioclase in certain less basic rocks. In one specimen (No. 2) collected from a beach boulder at Samamea in Fangaloa Bay, Upolu, plagioclase is especially plentiful and is developed not only in the groundmass but also as tabular phenocrysts as much as 1 cm. in length. The pyroxene of the rocks is generally a pale greenish-grey augite or diopside, though in a very large number it is pleochroic violet titaniferous augite.

In a dense non-porphyritic rock (No. 13) from Uafato Bay, Upolu, there is a very small unimportant quantity of a rhombic pyroxene determined as hypersthene, though it is in such small crystals that the determination is a little doubtful. It will be remembered that Jensen (1906) described an olivine-enstatite basalt from Savaii, but the two rocks are entirely dissimilar one from the other. There are numerous small flakes of biotite in the rock (No. 5) from Salimu in Fangaloa Bay. This mineral has been recognized in a number of other Samoan basaltic rocks by several other writers such as Moehle (1901, p. 4), Weber (1909, p. 294) and Daly (1924, p. 102).

The groundmass of the basalts is very often more or less pilotaxitic, and fluxional arrangement of the minute lath-like crystals of plagioclase is very well shewn in some instances (See Fig. 1).

There is, however, an expectable development of glass in several types, and one (No. 20), which obviously has cooled rapidly during solidification, has a groundmass which is completely vitrophyric. The grain-size is subject to considerable variation. There are a few coarse-grained doleritic basalts (Nos. 14, 31) and, at the other extreme, quite a number of finely microcrystalline varieties (Nos. 13, 17, 19, 21, 30) which can only be studied by the use of very high-power lenses (See Figs. 2 and 3).

In mineral constitution the groundmass consists essentially of plagioclase, a pyroxene, which is either diopside or a titaniferous augite, and oxide iron ores. Of these latter magnetite is more prevalent than ilmenite. The average content of these iron ores is about 9 or 10 per cent., though occasionally it is considerably in excess of this. The proportion of recognizable apatite is variable. It is usually inconspicuous, but in places occurs in very numerous minute needle-like prisms. It is often very difficult to obtain the variety of plagioclase in the groundmass, especially where fluxionally arranged laths are cut in unfavourable directions. In many slides, in addition to being very small, these "laths" are irregular in outline and yield poorly-defined albite twin lamellae. Where accurately determinable the variety is generally andesine-labradorite or acid labradorite, and is seldom more calcic than Ab_{45} An_{55}. In two instances (Nos. 25 and 34) the groundmass is unusual in that amongst the last-crystallized material there are much larger very poorly-defined crystals of a mineral which envelops most other constituents, including the usual small lath-like crystals of

labradorite. It was at first suspected that nepheline was present, though in some instances cleavage is visible and with this there is obtainable an extinction angle which, with the refractive index, indicates that the material is in part a plagioclase decidedly more acid than the labradorite of the laths it enwraps.

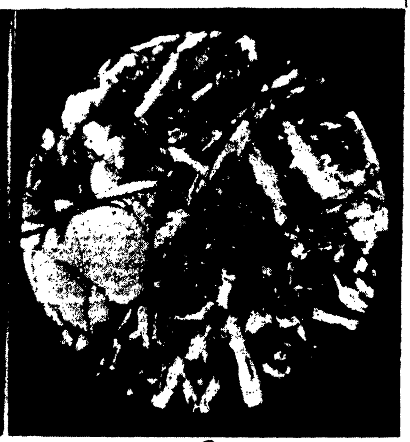
Confirmation of the suspicion that nepheline is also present was sought in staining tests, but these proved unsatisfactory, and recourse was had to digests of the finely powdered rock wih hydrochloric acid and subsequent evaporation of the solution. No cubes of sodium-chloride were obtained, so that nepheline apparently is not present, but it is by no means certain that plagioclase is the only mineral represented in this enveloping medium.

Detailed Description of Basalts.

1. *Picrite Basalts and ? Limburgites.* A striking example (No. 4) of picrite basalt was collected from a beach boulder at Masina, Fangaloa Bay, Upolu. In hand-specimen it appears to be closely crowded with phenocrysts of olivine and augite up to about 1 cm. in diameter, and the microscope section (See Fig. 4) indicates that the phenocrystic material is only slightly less in amount than the groundmass, for a micrometric analysis gave the volume percentages as follows:—olivine (phenocrysts) 20.2; augite (phenocrysts) 20; calcite (in vesicles) 2.7; groundmass 57.1. As the analysis (No. 2, Table 1) shews, the percentage of calcite in the material analysed is much higher than that estimated in the vesicles, and, as the rock is unweathered and the calcite seems to be entirely restricted to the vesicles, it appears that the fragments selected for analysis were especially rich in this mineral. The olivine is fairly sharply idiomorphic and shews only incipient alteration to serpentine. The augite is a zonally-built pinkish-brown titaniferous variety present in large moderately euhedral crystals. It has numerous minute inclusions of plagioclase, magnetite, occasional calcite and olivine and rare brown hornblende as well as some larger ones consisting mainly of pale-brown glass. The rock shews also a few microphenocrysts of moderately basic labradorite as much as 1.5 mm. in length. A Rosiwal determination of the proportions of the minerals of the finely crystalline groundmass was somewhat unsatisfactory, but indicated a greater proportion of pyroxene relative to plagioclase than is normatively present. The pyroxene includes both titaniferous augite and diopside. Magnetite constitutes about 17 per cent. of the groundmass, and needles of apatite are plentiful. The normative plagioclase is andesine-labradorite; modally the variety appears to be a little more calcic though precise determination is difficult.

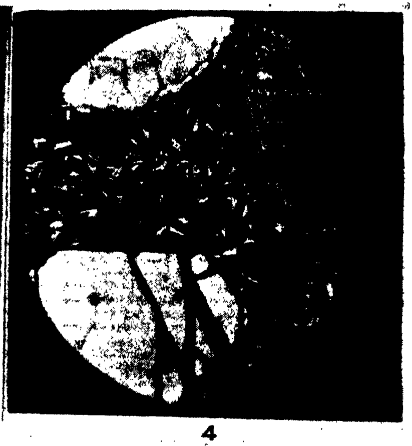
The name picrite basalt has been used for this and similar rocks of this group, following its use by Cross (1915, p. 29) for a similar rock from Haleakala, Hawaii. The chemical analyses of the two rocks are compared in Table 1, that for the Samoan rock being recalculated on account of the large amount of calcite noted in both mode and norm. In describing several "chrysophyric" basalts and picrite basalts from Hawaiian localities, Washington (1923) adopts as a means of separating the picrite basalts from other

1



2

3



4

Fig. 1. Olivine basalt (No. 3) with fluxionally arranged laths of plagioclase in groundmass. A phenocryst of olivine is visible, but none of plagioclase though many are present in the slide. Magnification 50 diams.

2. "Doleritic" olivine basalt (No. 14). The abundance of titaniferous augite is well exemplified. Magnification 35 diams.

3. Very fine-grained non-porphyritic basalt (No. 13) with microphenocrysts of plagioclase. Magnification 170 diams.

4. Picrite basalt (No. 4) shewing phenocrysts of olivine and augite and part of an amygdule of calcite. Magnification 35 diams.

Face p. 256.

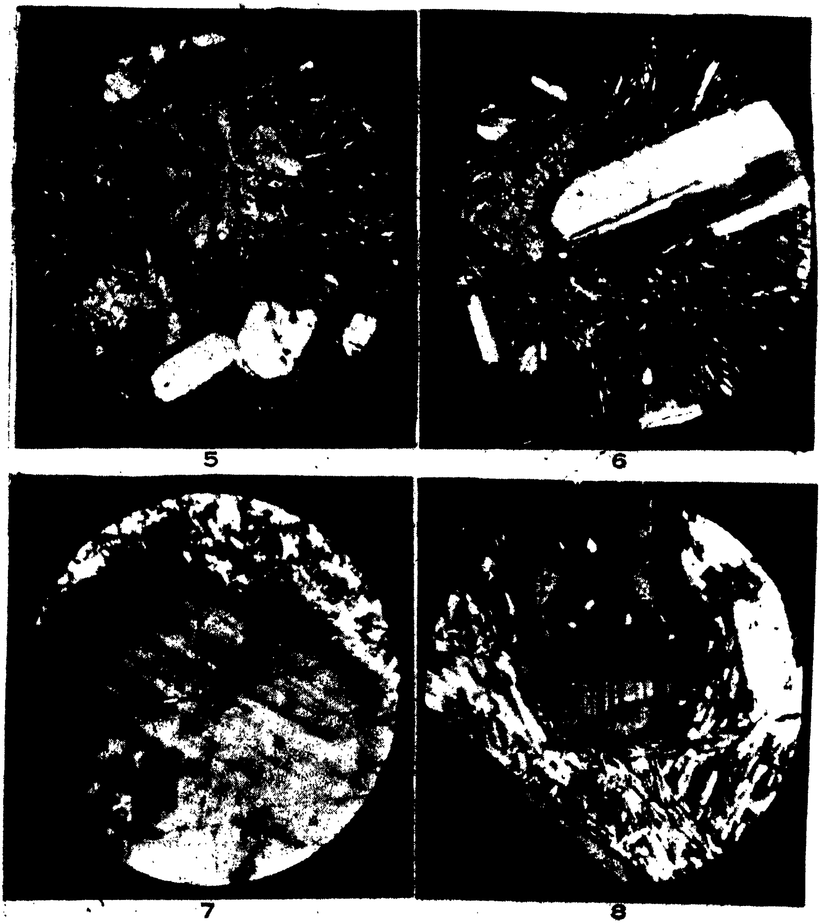


Fig. 5. Picrite basalt close to olivine basalt (No. 8) with stellate groups of titaniferous augite and phenocrysts of olivine (white) plainly visible. Magnification 35 diams.

6. Phenocrysts of plagioclase and augite in an olivine basalt (No. 2) rich in large phenocrysts of plagioclase.
Nicols crossed; magnification 35 diams.

7. Anorthoclase in anorthoclase trachyte (No. 1). A corrosion border is evident.
Nicols crossed; magnification 35 diams.

8. Probable albite with outgrowth of more calcic plagioclase from anorthoclase trachyte (No. 1). Trachytic structure of the ground-mass can be recognized.
Nicols crossed; magnification 50 diams.

olivine-rich basalts the criterion that in the former (picrite basalts) the femic minerals " dominate " over the feldspars. That is the lower limit of the percentage of femic minerals is fixed at 62.5. Apart from satisfying this criterion, the Samoan picrite basalts here described as such are not very similar to those described by Washington from Hawaii, for they have a greater proportion of phenocrystic augite and less olivine.

As pointed out clearly by Washington (1923, p. 470), however, the work of Bowen and Anderson shews that the mutual proportions of these two minerals depend very largely upon the rate at which crystallization has proceeded.

Another rather different picrite basalt (No. 22) comes from an outcrop at the shore-line at Suifaga, Savaii. An approximate micrometric determination of the mode gave the percentages of the constituents by weight as olivine 20, augite 59.5, labradorite (Ab_{45} An_{55} approx.) 11.0, magnetite and ilmenite 9.5. This is in distinct disagreement with the norm which is shewn in column 1 of Table 2, but it is probable that the discrepancy can largely be explained by the presence in modal pyroxene of lime and alumina normatively referred to anorthite. Olivine in numerous rather small idiomorphic phenocrysts generally under 1 mm. in greatest dimension, is the only phenocrystic mineral. The groundmass is holocrystalline and consists mainly of pinkish-violet titaniferous augite in small grains and prisms, along with magnetite and ilmenite and relatively long (0.15 mm.) laths of plagioclase. No nepheline was detected, though a little is shown by the norm.

There are one or two other picritic basalts which may, however, be allied to the limburgites. One of them is represented by slide No. 33 cut from a specimen of vesicular pahoehoe lava collected by Mr. F. Wood. Titaniferous augite in small but stout prisms, which are often arranged in stellate manner, is the predominant constituent; it encloses small sub-euhedral phenocrysts of olivine and numerous little crystals of magnetite, and upon it is moulded a small quantity (about 15 per cent. by volume) of plagioclase in highly irregular crystals up to 1.2 mm. in breadth, which often have their margins crowded with rods of ilmenite. Particularly in certain parts of the slide, there is a small quantity of almost colourless isotropic residuum which is apparently a glass, but may be analcite. This is closely permeated by minute somewhat dendritic though rod-like growths of ilmenite passing thence into the marginal portions of the crystals of plagioclase. In slide No. 26, cut from another rock collected by Mr. Wood, there is a far greater proportion (approximately 25 per cent. by volume) of brown " glass," and similarly there is more phenocrystic olivine than in the last rock. There is, however, no visible feldspar. It is regrettable that insufficient material was collected to enable an analysis of this rock to be made. In view of the uncertainty as to the true nature of the " glass " in these last two rocks, it is evident that classification of them as limburgitic basalts can only be tentative.

Of the remaining olivine-rich basalts there are several almost on the border-line between the olivine basalts and picrite basalts. This applies especially to the rock of a dyke at Samamea, Fangaloa

Bay, Upolu (No. 8), which is somewhat similar to the types which have just been described as possible limburgitic basalts, but is holocrystalline. The augite of this rock is mainly a violet titaniferous variety built often in most characteristic groups of stellately-arranged small prismatic phenocrysts (See Fig. 5). Olivine is very plentiful in fresh idiomorphic phenocrysts up to 1.5 mm. in length.

2. *Olivine Basalts.* It will readily be realized after what has been stated in the last section, that several of the rocks here classed as olivine basalts contain so great a proportion of femic minerals relative to plagioclase that they closely approach the picrite basalts. Their mineralogical composition varies only slightly in different specimens. The pyroxene of many is a titaniferous augite, in others a pale greenish-grey diopsidic variety, whilst this mineral may or may not form phenocrysts. Olivine is abundant in all rocks included in this group. A few of the olivine basalts, for example No. 31 of Wood's collection, are very coarse-grained and have their augite more or less ophitically related to the plagioclase.

Examples of the more basic olivine basalts are furnished by the following slides:—

No. 9: a boulder from the beach at Samamea, Fangaloa Bay, Upolu.
No. 17: from a well-shaft near Ofalau Hill, Mulifanui.
Nos. 24, 30, 31 of Wood's collection.

It should be mentioned, however, that slide No. 30 does not lend itself to very precise classification because it is a quickly-cooled type possessing a remarkably fine-grained groundmass which is almost opaque from closely-crowded iron ore.

More normal olivine basalts are illustrated by the following slides:—

No. 10: at west end of Samamea, Fangaloa Bay, Upolu.
No. 11: beach boulder, Uafato Bay, Upolu.
No. 14: west side of lagoon, Safatu Harbour, Upolu.
No. 15: from the beach, south side of Manono Is.
No. 16: near summit, Manono Is.
No. 18: stream boulder, Leafien Creek, near Falemanga.
No. 19: stream boulder, Lalia Creek, near Falemanga.
No. 20: one mile from sea, Matavanu lava field, Savaii.
No. 21: crater wall, Matavanu, Savaii.
Nos. 23, 25, 29, 32, 34, 35, 36 of Wood's collection.

Most of the above rocks differ from the more basic olivine-rich basalts previously listed only in an increased proportion of feldspar relative to femic minerals. Olivine is variable in amount, though always present more or less conspicuously. Usually it is very strikingly fresh, but occasionally exhibits reddish-brown oxidation-stains definitely oriented in parallel rod-like fashion as already noted by Moehle (1901, p. 34). Although in the slide of Matavanu lava (No. 20) a deep-brown almost opaque glass constitutes about 75 per cent. of the rock by volume, most of the rocks are more or less finely holocrystalline. Many have small vesicles which remain unfilled except in more weathered rocks, although in a few rare instances zeolites furnish a partial filling. Though the

texture of the groundmass is characteristically fine, a few rocks are coarse-grained and shew structural approach to the dolerites in their distinctly ophitic character (e.g. No. 14; see Fig. 2).

In addition to the usual laths of acid labradorite with accompanying augite, iron-ore and occasional apatite, there is in slide No. 34 the enveloping material partly referable to a more acid plagioclase, and perhaps also to orthoclase or other mineral, which has already been discussed above.

3. *Olivine Basalts with Plagioclase Phenocrysts.*—A very interesting basalt with numerous large rather tabular phenocrysts of plagioclase (Ab_{30} An_{70}) as much as 9 mm. in length in the slide (No. 2) examined (See Fig. 6), was collected from a beach boulder at Samamea, Fangaloa Bay, by Dr. Thomson. Olivine is represented by a few large pseudomorphs of deep-green serpentine and there are quite a number of rather ill-shaped phenocrysts of titaniferous augite with numerous small inclusions of magnetite, plagioclase and serpentized olivine. The groundmass is decidedly in excess of the phenocrysts and contains very abundant magnetite (about 15 per cent. by weight) along with the usual diopside and plagioclase; the latter is slightly in excess of the diopside, and is apparently andesine-labradorite.

Another rock from the east end of Samamea (No. 7) was amongst those forwarded for analysis, and the result is given in column 5 of Table 1, whilst in column 6, for comparison, there is the analysis of a similar Hawaiian rock described by Washington (1923, p. 493). In section this basalt is seen to possess a moderate number of large phenocrysts of augite and less numerous ones of plagioclase (acid labradorite), whilst olivine is comparatively plentiful in crystals up to 2.5 mm. in breadth; magnetite builds occasional large crystals in addition to occurring in moderate quantity in the groundmass. In this latter, plagioclase (basic andesine) is very abundant and forms about 60 per cent. of its bulk.

The normative plagioclase determined by the analysis can be seen from inspection of the norm set forth in column 5 of Table 2 to be acid andesine, though modally it is more basic. Thus a more precise classification of this rock is olivine-andesine basalt. There is a moderate quantity of orthoclase shewn by the norm and this very probably occurs modally as a feldspar-like material present in small amount in the groundmass, and enwrapping other minerals there precisely as has been described for slide No. 34. The only two other rocks of the collection, which, whilst possessing a moderate quantity of olivine, have also porphyritic plagioclase, are one (No. 12) collected from the boulder beach at Uafato Bay, Upolu, and another (No. 3) from a similar beach at Masina, Fangaloa Bay, Upolu. The groundmass of both approaches in structure that termed pilotaxitic, and the abundant laths of plagioclase shew perfect fluxional arrangement.

4. *Plagioclase Basalt.*—A type of basalt from a beach boulder at Salimu, Fangaloa Bay (No. 6), is distinct from others of the collection in that olivine is absent and the only phenocrysts are tabular crystals of labradorite up to 2.5 mm. in length.

The rock has close-spaced vesicles of the pahoehoe type and in section is poorly translucent by reason of the abundance of irregular

growths of ilmenite. These are intergrown and intermingled with the plagioclase, titaniferous augite, and magnetite of the groundmass, the plagioclase of this second generation being approximately equal in volume to the femic minerals.

5. *Non-Porphyritic (Aphyric)* Basalts.*—Only two of all the rocks of the collection fail to show clear evidence of two periods of crystallization. The first (No. 13), a beach boulder from Uafato Bay, Upolu, is a remarkably dense and fine-grained rock poorly translucent in thin section by reason of the close packing of small crystals of magnetite. There are a few microphenocrysts of this last mineral and of more or less completely serpentinized olivine. Numbers of scattered small laths of plagioclase seldom over 0.15 mm. in length perhaps also deserve to rank as microphenocrysts, for they contrast in size and clear-cut definition with the imperfectly-defined feldspathic material enwrapping the abundant minute crystals of diopside and magnetite of the general matrix (See Fig. 3). An unusual additional mineral present in infrequent small prisms 0.05 mm. up to 0.2 mm. in length is identified as hypersthene. It shews the usual straight extinction, characteristic cross-fracture and negative optical character, though no pleochroism was detected. Very rare tiny flakes of biotite were also noted.

The other aphyric rock (No. 5) is unique in the collection, and comes from a beach boulder at Salimu, Fangaloa Bay. Like the last it is very dense and fine-grained and lacks true phenocrysts, although it has numerous small microphenocrysts represented by plentiful flakes of deep-brown biotite, seldom more than 0.15 mm. in length, occasional crystals of magnetite and a number of laths of plagioclase distinctly larger than those of the general matrix.

Chlorite has in places replaced the biotite and provides the filling of occasional minute vesicles. It is difficult to determine the variety of plagoiclase present, but it is not less calcic than acid labradorite; an approximate micrometric analysis gave the percentage of feldspar by weight as 60, so that this basalt comes very near the border-line between andesites and basalts following the usage of Iddings and Washington,† if it does not actually fall within the group of andesites, since the normative plagioclase is likely to outweigh the modal. If, however, the silica content be calculated from the mode, the rock falls within the usually accepted chemical limits of the basalt group.

ANORTHOCLASE TRACHYTE.

A very interesting trachyte was found by Dr. Thomson amongst the boulders of the beach at Masina, Fangaloa Bay, Upolu.

Macroscopically it is a typical porphyritic light-grey trachyte, with plentiful large phenocrysts of anorthoclase or other feldspar which are as much as 1 cm. in greatest dimension, but seldom have the euhedral tabular form so common in similar rocks. Besides the feldspar there are scattered crystals of dark ferromagnesian mineral which, though usually small, occasionally are as much as 4 mm. in breadth.

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*See Washington, H. S., 1923, p. 474.
†See, for example, Washington, H. S., 1923, pp. 468-9.

In section (No. 1) there is a trachytic groundmass, in which clear-cut laths of feldspar dominate over somewhat granular aegirine-augite and accompanying magnetite, and shew perfect fluxional parallelism; this builds about 60 per cent. by volume of the rock and in it are set a considerable number of large phenocrysts of feldspar with far less numerous small ones of more or less completely resorbed brown hornblende, of yellowish olivine and occasional magnetite.

The phenocrysts of feldspar are dominantly anorthoclase; usually they have ill-defined borders and shew a narrow sub-marginal zone of corrosion beyond which there is often outgrowth of similar material (See Fig. 8). They enclose numerous irregular inclusions of deeply pleochroic aegirine-augite, magnetite, and perhaps colourless glass. Under crossed nicols they generally show the characteristic minute discontinuous and indefinite intersecting twin lamellae (Fig. 7), but in some instances they exhibit more regular albite lamellae and can then only be separated with certainty from albite by their negative optical character and small axial angle.

In addition to anorthoclase there are a few large idiomorphic crystals of a plagioclase which gives the extinction angles of acid andesine, though one small fragment enclosed in a larger crystal is as calcic as andesine-labradorite. Rare crystals of albite may be present, though the observations are not as conclusive as desirable. A crystal of such probable albite is illustrated by Fig. 8; beyond the prominent corrosion-zone there is an outgrowth of a feldspar with decidedly higher indices of refraction than those of the inner mineral, and it appears therefore to be more calcic plagioclase than albite. The plane of the section is in this case is unfortunately not truly normal to the composition-planes of the albite twin lamellae, but, admitting this, the extinction-angles obtained with alternate sets of such lamellae (4° and 17°) seem inconsistent with those expectable with anorthoclase, and for this reason it is suggested that the mineral is albite.*

The hornblende noted already as one of the minerals of the first generation, shews deep-brown tints and strong pleochroism. It is generally present in association with abundant corrosion-products represented by grains of pyroxene intermixed with crystals of magnetite and feldspar, whilst corrosion-pseudomorphs may alone represent the mineral.

Olivine is not plentiful, whilst apatite is a conspicuous accessory mineral, for it is in comparatively large bluish-grey faintly pleochroic prisms as much as 0.15 mm. in thickness.

The trachytic groundmass is practically wholly of alkali feldspar in laths averaging about 0.25 mm. in length, with 8 per cent. or 9 per cent. of prisms and grains of aegirine-augite and crystals of magnetite. The majority of the laths exhibit simple twinning and have straight extinction; in all probability these are soda orthoclase. Others shew albite twinning of an irregular kind and have small extinction angles; the analysis (No. 7, Table 1) makes it almost certain that these represent anorthoclase, though the writer was unable to decide this by determination of the optical character and optic axial angle.

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*The optical character could not be ascertained.

An interesting feature in connection with the analysis of this trachyte is that the modal olivine is reflected in the norm (See column 7, Table 2). There is great similarity between this Samoan trachyte and anorthoclase trachytes described by Skeats and Summers (1912) from the Macedon district of Victoria, and an analysis of one of these latter rocks is given in column 8 of Table 1 for purposes of comparison.

Discussion of Analyses.

Analyses by Mr. F. T. Seelye of the Dominion Laboratory of four of the West Samoan rocks are set forth in Table 1, with accompanying analyses of a few rocks from elsewhere which are comparable with certain of the Samoan ones. Table 2 furnishes corresponding norms and quantitative classifications.

TABLE 1.

Analyses.

—	1	2	3	4	5	6	7	8
SiO_2 ...	43·82	42.19	44·83	42 99	48 35	48·42	60·48	60·10
Al_2O_3 ...	11·26	9·03	9 60	10·21	12·39	13·97	18 16	18 38
Fe_2O_3 ...	2·39	3·03	3·22	3·01	3·27	4·17	1·99	2·22
FeO ...	9·53	9·27	9·85	10·28	8·35	9·57	2·92	3·34
MgO ...	13·59	13·89	14·76	14·61	8·76	4 61	0·73	1·30
CaO ...	10·22	11·95	9·20	12·54	8·54	8·86	2·13	2·28
K_2O ...	1·43	0·47	0·50	0·52	1·69	1·29	4·12	4 57
Na_2O ...	2·08	1·77	1·88	1·40	3·28	3·30	7 27	5·30
H_2O+ ...	0·75	1·03	1·10	1·10	0·37	0·84	0·68	0 43
H_2O- ...	0·60	1·02	1 09	0·82	0·54	0 42	0 30	0·96
CO_2 ...	trace	2·61		nil	0·02		nil	trace
TiO_2 ...	3·09	2.72	2·89	2·62	3 48	3·25	0 39	0 69
ZrO_2 ...	nil	nil	nil	nil	nil		0 08	
P_2O_5 ...	0·69	0·71	0 75	0·29	0·89	0·91	0 38	0·33
S ...	0·02	trace	trace		0 02		trace	
Cr_2O_3 ...	0·10	0·12	0 13	0 06	0·06		nil	
NiO ...	0·05	0·04	0·04	0·06	0·03		nil	
MnO ...	0·25	0·19	0 20	0 17	0·22	0·17	0 17	nil
SrO ...	0·02	0 02	0·02	nil	0·02		0·02	
BaO ...	0·05	0·04	0·04	nil	0 04		0·07	
Ce_2O_3 &c....							0·03	
SO_3* ...	0·17							trace
NaCl* ...	0·09	trace	trace		0·09		0·04	
Cl ...						nil	0·03	nil
	100·20	100·10	100·10	100 58	100·41	99·78	99·99	99 90

*Water-soluble salts.

1. Picrite basalt (No. 22), *in situ* at beach, Suifaga Savaii. Seelye analyst.
2. Picrite basalt (No. 4), beach boulder, Masina, Fangaloa Bay, Upolu. Seelye analyst.
3. Recalculation of analysis 2 on the basis of absence of calcite.
4. Picritic basalt, Haleakala, Hawaii. Steiger analyst. Cross, 1915, p. 29.
5. Olivine basalt with plagioclase phenocrysts (No. 7), east end of Samamea, Fangaloa Bay, Upolu. Seelye analyst.

6. Aphyric andesine basalt, Papalele Gulch, Mauna Kea, Hawaii. Washington analyst. Washington, 1923, p. 493.
7. Anorthoclase trachyte, from beach boulder, Masina, Fangaloa Bay, Upolu. Seelye analyst.
8. Anorthoclase trachyte, eastern slope of Mount Eliza, Macedon district, Victoria. Bayley, Hall, Lewis and Topp analysts. Skeats and Summers, 1912, p. 25.

TABLE 2.

—	1	2	3	4	5	6	7	8
Quartz .						0·84		4·32
Orthoclase ...	8 84	2·78	2·95	2·78	10·01	7·78	24·46	27·24
Albite ...	11·00	15·20	16·15	6·29	27·77	27·77	57·11	44·54
Anorthite ...	17·24	15·01	15·95	20·02	14·18	19·46	4·45	9·73
Nepheline ...	3 69			3·12			2·56	
Corundum ...								1·12
Diopside ...	22·89	18 65	19·82	32 28	18 22	15 49	2·81	
Hypersthene		11 01	11·80		3·92	12·88		6·37
Olivine ...	24·31	18·07	19·20	24·23	11·77		2·65	
Magnetite ...	3·48	4·41	3·69	4 41	4·87	6·03	3·02	3·25
Ilmenite ...	5·93	5·17	5·49	4·71	6·69	6·23	0·76	1·37
Apatite ...	1·68	1·68	1·79	0·67	2·02	2·02	1·01	0·60
Calcite ...		(5 90)						
Symbol	III.'' 5'' 3 4	(III)IV (1) 2 (1) 2 2	(III.)IV. (1) 2 (1) 2 2	'IV. (1) 2 2 2	III 5 "3 4	III. 5 3 4	I. (II.) 5 1" 4	I. 5 2 3

So far as the basalts are concerned, Daly (1924) has published several analyses by Washington of rocks which are closely similar to those of corresponding rocks of Western Samoa. It is also interesting to find borne out by analysis the close petrographic similarity between Samoan and Hawaiian rocks already remarked modally by several earlier writers. Daly has also described several trachytes from Eastern Samoa, but none appears to be analogous to that from Masina. He has discussed (1924) in lucid manner the association in Samoa and elsewhere of basaltic and trachytic types, tracing the descent of these and of rocks intermediate between them, by the process of differentiation from the magma of a general basaltic substratum, which at times may, however, have formed syntectics with crust rocks. The relations in time and space between the basalts and the trachyte collected by Dr. Thomson and Mr. Wood are unknown, but they are likely to be those established for American Samoa by Daly (1924), so that this latter writer's conclusions have a direct bearing upon the discussion of the genesis of the various rocks described in this paper. It may be mentioned, however, that Washington (1923, pp. 365-6) in reviewing the evidence afforded by similar association of basalt and trachyte in Hawaii in the light of a complete series of analyses, concludes that it is adverse to Daly's (1911) hypothesis that the trachytes in those islands have originated by assimilation of limestone by basaltic magma.

Literature of West Samoan Petrography.

Thomson (1921) furnishes a summary of the types of igneous rock then known from West Samoa and the full bibliography attached to his paper has proved very useful to the present writer. Many of the papers listed there have petrographic interest. Many, however, have not been accessible locally, and the following list embraces only those examined by the writer that contain important petrographic material; it further includes a few papers not directly concerned with Samoan petrography which have been referred to in the text. These last are distinguished by an asterisk immediately following the date.

Cross, W., 1915.* Lavas of Hawaii and their Relations, *U.S. Geol. Surv. Prof. Paper* No. 88.

Daly, R. A., 1924. The Geology of American Samoa, *Pub. No. 340, Carnegie Inst. of Washington.*

———1911* Magmatic Differentiation in Hawaii, *Journ. Geol.*, vol. 19, p. 309.

Jensen, H. I., 1907. The Geology of Samoa, and the Eruptions in Savaii, *Proc. Linn. Soc. N.S.W.*, vol. 31, pp. 641–72.

Kaiser, E., 1904. Beitraege zur Petrographie und Geologie der Deutschen Suedsee-Inseln, *Jahrb. d. K. Preuss. Geol. Landes. u. Bergak.*, Bd. 24, H. 1, pp. 91–121.

Klautzcsh, A., 1907. Der jeungste Vulcanausbruch auf Savaii, Samoa, *Jahrb. d. K. Preuss. Geol. Landes. u. Bergak.*, Bd. 28, H. 2, pp. 169–182.

Moehle, F., 1901. *Beitrag zur Petrographie der Sandwich—und Samoa—Inseln*, Klett & Hartmann, Stuttgart. Republished in 1902; (see Thomson, 1921.)

Skeats, E. W., and Summers, H. S., 1912*. The Geology and Petrology of the Macedon District, *Geol. Surv. Victoria Bull.* No. 24.

Thomson, J. A., 1921. The Geology of Western Samoa. *N.Z. Journ. Sc. & Techn.*, vol. 4, pp. 49–66.

Washington, H. S., 1923.* Petrology of the Hawaiian Islands, *Am. Journ. Sc.*, vol. 5, pp. 465–502; vol. 6. pp. 100–126, 338-367, 409–423.

Weber, M., 1909. Zur Petrographie der Samoa-Inseln, *Abhandl. K. Bayer. Akad. d. Wiss.*, 2 Kl., Bd. 24, Abth. 2, pp. 290–310.

The Geology and Palaeontology of the Lower Waihao Basin, South Canterbury, New Zealand.

By R. S. ALLAN, M.Sc., Otago University.

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CONTENTS.

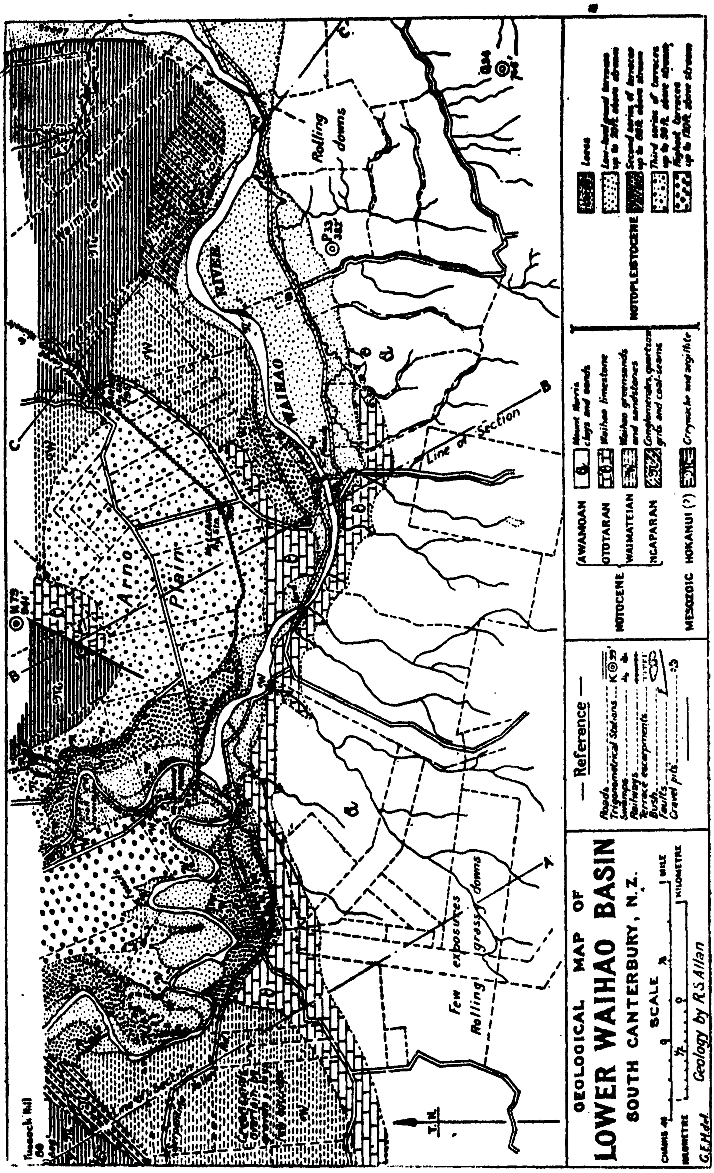
INTRODUCTION.

The area under consideration is part of the lower Waihao basin, in the county of Waimate in South Canterbury. A block of country 30 square miles in area has been mapped. The northern boundary runs east from Tussock Hill for 10 miles, while the western boundary follows a line drawn south through Tussock Hill for a distance of 3 miles. The eastern and southern boundaries complete the rectangular block.

In the preparation of this paper the writer has to acknowledge his indebtedness to Mr. H. J. Finlay and Dr. J. Marwick for considerable help in the determination of the fossil mollusca; to Dr. J. A. Thomson for the determination of Brachiopoda; to the late Mr. R. Murdoch for the identification of land mollusca; and finally to Dr. W. N. Benson for his able teaching, friendly criticism, and helpful advice.

WORK OF PREVIOUS INVESTIGATORS.

The first notice of the geology of the Waihao area is that of von Haast in his *Geology of the Provinces of Canterbury and Westland,* 1879. He recognised two formations, viz., a lower, Oamaru formation of Upper Eocene or Lower Miocene age; and an upper Pareora formation, of Upper Miocene or Lower Pliocene age. The Waipara series, of Cretaceo-tertiary age, Haast considered was not developed in the area. Von Haast seemed to favour the idea that the



Pareora beds (Awamoan) were deposited on and around islands of the Oamaru formation in a later sea; for he says:—

"In many localities, e.g., Waihao River, the calcerous greensands have become greatly denuded before the Pareora beds were deposited above them, or which is more commonly the case, along them, when the former stood as islands in the tertiary sea." (1879, p. 318.)

Lindop, 1885, gave a very brief description of the coal-seams which were being utilised at the time of his visit.

In 1875 von Haast sent to Hutton at the Otago Museum a collection of fossils from four localities, viz., White Rock River, Pareora District; Mount Harris and Point Hill, between the Waihao and Waitaki Rivers; and from certain greensands exposed at Waihao Forks. Hutton referred the whole to his Pareora formation (*Trans. N.Z. Inst.*, vol. 9, p. 593). Von Haast was not satisfied, since his work suggested to him that the fossils from the Waihao greensands came from beds below the limestone. Thus was laid the foundation of a long controversy between the Geological Survey, represented by McKay, on one hand, and Hutton on the other.

McKay first published an official account of the area in 1882. It is couched in terms of the Cretaceo-tertiary hypothesis of Hector, which unfortunately led him into a false interpretation of the Waihao sequence. His correlations with the beds of North Canterbury cannot be upheld. He gives the following succession for this area:—

Age.	Formation.
Recent to Pliocene	Alluvial and glacier deposits.
Lower Miocene	Gravels and sands, with lignite beds. Pareora clays.
Cretaceo-Tertiary	Ototara limestone. Chalk-marls (=Amuri Limestone) Marly greensands. Island sandstone. Coal Beds.
Carboniferous Upper Devonian	Matai Series Te Anau Series } (Mapped together).

McKay considered the Mt. Harris beds to rest with marked unconformity on his Cretaceo-tertiary beds since the Upper Eocene beds of Hector are said to be absent from the district.

All the beds below the Mt. Harris beds are referred to the Cretaceo-tertiary. The Waihao limestone is correlated with the Ototara stone and with that of Maerewhenua. The lower part of the limestone was correlated with the " chalk-marls " and was considered the equivalent of the Amuri limestone. The " Marly greensands " ere shown to be inferior to the limestone and to contain well-preserved fossils.

Apart from his belief in an unconformity above the limestone, McKay gives a sequence which has been accepted by all other geologists who have visited the area except Hutton; and which, were it not couched in the confusing terminology of the Cretaceo-tertiary hypothesis, would still be a very satisfactory description. Hutton, however, was not satisfied. From his examination of von Haast's fossils he believed that the Waihao greensands belonged to his Pareora formation, i.e., the greensands were younger than the limestone which he placed in his Oamaru formation, therefore he visited the area in 1885 " to clear up the difficulty." (1887, p. 430.) The point to be settled was this—"Do these greensands underlie the Marl of the Oamaru system. (i.e., underlie the Waihao limestone) or do they lie unconformably against the eroded edges of that System?" (1877, p. 431.)

He proved to his own satisfaction that the palaeontological evidence was in favour of the latter supposition. "The stratigraphical evidence is not so satisfactory, for no clear sections exist... in no case are they (the greensands) seen to pass below the marl or to lie upon it; consequently the palaeontological evidence must be taken as proving the superior position of the greensands." (1887, p. 432.) Hutton gives a surprising section to illustrate his views but remarks, "it is of course to some extent hypothetical, as no positive stratigraphical evidence is available." (1887, p. 433.)

In September, 1886, McKay, after a further visit to Waihao replied to Hutton's stratigraphical evidence thus:—"It is so much at variance with the conclusions of all other observers, and in itself a statement so positive, that it requires to be supported by proofs equally decisive and incontrovertible; and if true, the conclusion is unavoidable that at least four geologists (Dr. von Haast, Park, Lindop, and myself) have imagined they saw that which cannot be seen. Ours, however, is testimony of a positive character; Professor Hutton's is simply that he did not see." (1887, p. 101.)

McKay then stripped the problem of its local significance and made it apply to the whole question of the succession of the younger beds of New Zealand, holding that Hutton was in error, not only with regard to these Waihao beds but also with those of a more or less similar nature at Kakahu and Hampden which he had placed in his Pareora System. McKay showed quite conclusively that the greensands do pass under the limestone and gave several convincing sections to prove his point. He then attacked Hutton's palaeontological evidence; but as Hutton later remarks, "Mr. McKay... although an excellent collector, has not yet shown any great acquaintance with Palaeontology." (1888, p. 266.) It would serve no purpose to follow up the palaeontological dispute.

In October 1886 McKay published a further paper in answer to Hutton's criticism. For the most part, it is a resumé of the previous report. He summed up the position as follows:—"Beyond all question, the greensands underlie the Waihao limestone: and as explanations of the contrary view, islands and fiords without number, crush, faults, contortions and, in short, all that might render the geology of a district complicated and obscure, are invoked in vain." (1887, p. 439.)

In 1888, Hutton answered McKay's criticism of his palaeontological evidence, but little of use evolves.

Professor Park, 1905, gave the following sequence of beds exposed on the banks of the Waihao River. (1905, p. 527.)

Waitaki Stone	1. Calcareous sandstone.
Mount Brown Beds.	2. Greensands. 3. Bluish-green sandy clays and sandstones with hard calcareous layers.
Waihao Beds	4. Bluish-green sandstones. 5. Grey Sandstones. 6. Quartzose grits, shales, fire-clays and brown coal.

He said (1905, p. 527) "the succession is almost identical with that seen in the Waitaki Valley." He disagreed with Hutton, and agreed with McKay that beds 3 are beneath the Waihao limestone. He showed that the greensands and bluish-green sandy clays are in all exposures inferior to the limestone; and the beds "follow the contours of the escarpments in such a way as to everywhere preserve the same relative position with respect to the Waitaki Stone. ... Captain Hutton attempts to explain this by suggesting that his Oamaru series of Oligocene age was deposited, elevated, sculptured into narrow valleys and channels, and again submerged so as to permit the accumulation of his Pareora beds on the newly eroded channels." (1905, p. 528.) Professor Park concludes, "The stratigraphy is not obscure nor the sections involved; and I fully concur with McKay's interpretation, which is, moreover, borne out by the sections at Black Point, Wharekuri, and Kakahu." (1905, p. 528.) Of the beds considered to be above the limestone by the writer Professor Park remarks "The Mount Harris beds in this neighbourhood contain a fauna which is the same as that of the Waihao clayey greensands, and, (they) nowhere overlie the Waitaki Stone. ... The Stratigraphy is not very clear, but the palaeontological evidence clearly correlates these beds with the Waihao Forks, Black Point, and Hampden Beds, which are acknowledged by the Survey to underlie the Waitaki Stone." (1905, p. 529.)

In 1910, p. 120 *et seq.* Professor Park again made a similar statement. This conclusion is one which does not accord with the writer's observations and one which is later (1918) corrected by Professor Park himself.

Dr. Thomson, 1914, reported on the coal prospects of the Waihao area. He gives the first detailed map of the area. This map has been the foundation of that prepared by the writer. A concise account of the topography and physiography is given and it is pointed out that the lower course of the Waihao is relatively new and is an excellent illustration of stream piracy. A general account of the geology follows; the Tertiary rocks are subdivided into four groups as follows:—

1. Mt. Harris beds;
2. Limestones;
3. Greensands; and
4. Coal Measures.

The coal-beds are then discussed, and a table of 13 analyses is given (see below). Dr. Thomson sums up in these words: "It follows, therefore, from the poor quality of the coal, its hydrous nature, and the difficulties of mining, that the Waihao area is never likely to become an important coalfield, although a small amount of coal may be mined around the outcrop for household use in Waimate and the surrounding district." (1914. p. 162.)

Dr. Marshall, 1915, publishes lists of fossils collected by Dr. Uttley from the Waihao District. Fossils were collected both from the Waihao greensands and from the Awamoan beds at Mt. Harris and Elephant Hill. No stratigraphical break was observed in the sequence. The age of all the beds is stated to be probably Miocene.

Dr. Thomson, 1915, draws attention to the fact that the fauna of the Mount Harris beds is apparently similar to that of the Waihao greensands. This resemblance seems to the writer to be more apparent than real, and it will be shown that the two faunas are distinct.

Dr. Thomson follows McKay's sequence, for he states "That position has not been challenged since 1888, and after a few days' study in the field is, to my mind, self-evident." (1915, p. 123.) He also shows that the Cretaceo-Tertiary theory of Hector and McKay is untenable. "All the beds in the Oamaru and South Canterbury districts classified by Hector and McKay as Cretaceo-Tertiary, and notably the Waihao greensands, contain only Tertiary fossils." (1915, p. 123.)

Dr. Thomson, 1916, disagrees with the correlation of the Waihao greensands with the Awamoa beds and of the Waihao limestone with the Hutchinsonian. His evidence "suggests strongly that the Waihao limestone is the correlative of the Ototara limestone, and the Waihao greensands the correlatives of the Enfield-Windsor beds." (1916, p. 32.)

In 1918, Professor Park corrects his error of 1905. He says (p. 110) "At Waihao in South Canterbury, the Waihao stone, a calcareous glauconitic sandstone, is underlaid by greensands and followed conformably, as shown by McKay and Thomson, by the Awamoan Mount Harris beds." The Waihao stone is placed in the Hutchinsonian. Professor Park says "The view that the Waihao stone is the time equivalent of the Oamaru stone (=Ototaran) would imply the absence of the whole of the Hutchinsonian in South Canterbury. Such a hiatus would mean an unconformity between the Waihao stone and the Mount Harris beds, of which, however, there is no evidence." (1918, p. 110.)

Professor Park's table of correlations of Oamaru, Waitaki and Waihao Cainozoic strata is appended.

	Oamaru District	*Lower Waitaki Valley*	*Waihao District*
Awamoan	Blue clays and shelly sands.	Sandy beds.	Blue clays and sands, calcareous.
Upper Hutchinsonian	Glauconitic s. stone. (Devil's Bridge, Landon Creek)	Calcareous glauconitic sandstone (Waitaki stone).	Glauconitic sandstone. (Waihao Stone)
Lower Hutchinsonian	Greensands.	Greensands.	Greensands.
Ototaran	Coralline (Oamaru) limestone.	Bluish-grey Glauconitic sandy beds.	Bluish-green sandy beds.
Waiarekan	Sandy clays and sandstones.	Sandy beds and sandstones.	Sandy clays and sandstones.
Ngaparan	Quartzose sands, etc., with lignite.	Quartzose sands, etc., with lignite.	Quartzose sands, etc., with lignite.

Mr. Morgan, 1919, discussed the limestone and phosphate resources of New Zealand. He gives several analyses of the Waihao limestone which are quoted below.

Professor R. Speight and Mr. L. J. Wild, 1919, gave a useful discussion on the limestone and phosphate-bands developed in Canterbury. A phosphatic band is noted in the Waihao greensands at McCullough's Bridge (1919, p. 185). A full description of a section of the limestone exposed three-quarters of a mile East of McCulloughs Bridge is also given (p. 185). Most limestone-exposures were visited and phosphate-bands noted. It is pointed out that the Otaio limestone of the Pareora district resembles the Waihao stone in age and character.

The glauconitic sandstones (greensands) of Waihao were examined. They show a small percentage of P_2O_5 "not only distributed through the rock but concentrated at times into layers of phosphatic nodules." (1919, p. 187.)

Four analyses of the Waihao stone are given below which show "that the amount of phosphate contained in the rocks is nowhere large enough to warrant them being called high-grade phosphates." (1919, p. 189.)

Dr. Marshall, 1920, in a discussion on "the Hampden beds and the New Zealand Tertiary Limestones" tends to correlate the Waihao greensands, lithologically and palaeontologically, with the Hampden beds. "The Hampden beds may be considered as of much the same age as, though perhaps a little older than, those at Waihao." (1920, p. 112.) He further correlates the Waihao limestone with that of Otiake, Waitaki Valley and shows them to be of a similar origin. "The Waihao and Otiake limestones, were deposited nearer to the shore (than the Ototaran limestone), in an area to which terrigenous sediment was carried and where tidal scour disturbed the sea-floor." (1920, p. 112.)

Dr. Uttley, 1920, shows that the sequence of Notocene beds in the Upper Waitaki Valley—Wharekuri to Otiake—is similar to that at Waihao. He suggests that the greensands between the coal-measures and the limestone at Wharekuri and Waihao could be subdivided. Another paper by the same author is a criticism of Professor Park's Oamaru Bulletin No. 20, particularly his view of the occurrence of limestones belonging to two different stages. Dr. Uttley "after an excursion to the Waihao District of South Canterbury, was convinced that, where the full series was developed, there was but one limestone present." (1920, p. 171.) He concurs with Dr. Thomson's opinion that the fauna beneath the limestone (greensands) bears a remarkable resemblance to the fauna above the limestone (Mt. Harris beds) in the Waihao district. where the beds occur in the same section. This view the writer considers is now untenable.

In other respects Dr. Uttley's conclusions are strengthened by the present work. These include the following points:—(1920, p. 182.)

1. Professor Park's Lower Hutchinsonian is the true Hutchinsonian of Dr. Thomson.
2. Professor Park's Upper Hutchinsonian is really Awamoan.

These two points may be considered together. The beds from Waihao placed by the writer in the Hutchinsonian cannot be divided

into two parts, either lithologically or palaeontologically. Dr. Thomson (*in litteris*) says that the brachiopods collected by the writer are all referable to species found in the Hutchinson Quarry beds at Kakanui and other localities near Oamaru. The evidence of the brachiopods would lead him to correlate the Waihao beds with the Kakanui greensands, *i.e.*, with Professor Park's Lower Hutchinsonian. Hence, since these beds at Waihao merge above into typical Awamoan clays, the Upper Hutchinsonian of Professor Park is not developed, at least not as a geological unit, with a lithological and palaeontological facies worthy of a sub-stage. If this sub-stage is present it is really the basal part of the Awamoan, Mt. Harris series.

3. Dr. Uttley deduces evidence to prove that the limestone in the Waitaki Valley is Ototaran and not as Professor Park suggests Hutchinsonian.

Professor Park himself correlates the Waihao limestone with that developed in the Waitaki Valley (1918, p. 110). But in the sequel the writer shows that the Waihao limestone is Ototaran but at the same time is not prepared to urge its correlation with all the limestones present in the Waitaki Valley.

Dr. Thomson, collected fossils from the Waihao greensands and from the Mt. Harris beds during the years 1913 and 1917. The molluscs were identified by Suter and the lists published in *N.Z. Geol. Surv. Pal. Bul.*, No. 8, 1921.

Dr. Cotton, 1922, cites an example of a fossil plain on "the westward slope of the Hunters Hills, with which are associated other similar slopes surrounding the depression that forms the Waihao basin, descending westward to the Hakataramea Valley, and extending as far as the Waitaki River" (1922, p. 141). He also demonstrates that the east side of the Hunters Hills is either a composite fault-scarp, or (being of no great height) possibly entirely a fault-line scarp (1922, pp. 171-2).

Dr. Marshall and Mr. Murdoch (1923) collected from the greensands at McCullough's Bridge. Four new species of Mollusca were described (1923, pp. 123-128). Dr. Marshall (1923) discusses the early Tertiary Faunas of New Zealand and he lists some 70 species from McCullough's Bridge, most of which were collected by Murdoch and himself. His analysis of this list is as follows:—

17% found in the Hampden beds only.
44% occur in the 96 species of the Hampden beds as well as various Tertiary deposits.
43% occur among the 215 species of the Target Gully species.
10% are of Recent occurrence.

These figures will be substantially altered by the writer because of the revision of the fauna and additions made thereto. In particular he cannot recognise the presence of any recent species, but Dr. Marshall's conclusions are still valid. "These facts show how much more closely this fauna is related to the fossils of the Hampden strata than to those of Target Gully ... the Waihao beds, though closely related to those at Hampden, are distinctly younger than them—a re-

sult that would be anticipated from the stratigraphy, and has already been stated as probable." (1923, p. 119.)

Professor Park, 1923, briefly answers the criticism of Dr. Uttley (1920). He has again visited the Waihao area and restates his argument of 1918 to prove that the Waihao stone is Hutchinsonian. "Clearly, if the Mt. Harris beds are Awamoan, the Waihao stone must be Hutchinsonian." (1923, p. 83).

The discovery of the *Liothyrella boehmi* assemblage of brachiopods in his "Lower Hutchinsonian" is used by him to strengthen the proof that in the Oamaru district there are limestones in two horizons. One—the upper Hutchinsonian, including the Kakanui, Deborah, Waitaki, Maruwhenua, Ngapara and Tokarahi limestones separated by the *Liothyrella boehmi* band from the lower horizon—the Ototaran, Oamaru stone. This conclusion may be valid for the Oamaru district south of the Waitaki Valley although it has been adversely criticised by Dr. Uttley and others; but the writer's work goes to show that it is not applicable to the Waihao area. The evidence to be given and the conclusions deduced from determinations by Dr. Thomson of brachiopods collected by the writer, seem to prove that the Waihao limestone is Ototaran. As a further piece of evidence for this conclusion, it is shown for the first time that Hutchinsonian beds with a characteristic brachiopod fauna are present in the area.

Dr. Marwick, 1924, described the Naticidae collected by the writer from the Waihao greensands. This family of gasteropods is well-represented in the Lower Tertiary beds of this district and it would seem that the species are valuable zonal indices.

General Account of the Geology of the Area.

Three classes of rocks are present in the district, viz.,

1. *Pre-Notocene*: greywacke and argillites, strongly folded and truncated by an erosion plane. These beds are well jointed, and partially altered. They are overlaid with marked unconformity by
2. "*Notocene*": (here Cainozoic beds only) forming an accordant rock series and making up a structural and physiographical unit. The rocks composing this unit are: conglomerates, sandstones, greensands, limestones, clays and sands. They are only gently folded or warped and much less hard and compact than the older rocks.
3. "Notopleistocene": horizontal uncemented gravels, silts and loess deposits, lying unconformably on 2.

The history of this area seems to have been as follows:—

Near the end of the Palaozoic era the sea advanced over the area and a great series of clays and muds was deposited. This sea does not seem to have been rich in organisms, for only traces of life can now be found. This period of sedimentation perhaps lasted intermittently until the end of Jurassic times.

In the early Cretaceous period, however, the land was subjected to intense orogenic movements—the post-Hokonui orogeny of Dr. Thomson (1917). No trace of the earliest beds of the Notocene succession, namely the Clarentian (Albian and Cenomanian) or Piripauan (Senonian) occur in the district. Hence it is concluded that while the "Cenomanian overlap"* and later the Senonian sea covered

*Phrase used by H. Woods, *N.Z. Geol. Surv. Pal. Bul., No. 4*, 1917, p. 4.

the area in North Canterbury and East Marlborough, the land in this region was still above sea-level. During this period the older rocks seem to have been greatly indurated and eroded to a peneplane.

At the beginning of "Eocene" times the land sank relatively to the sea. The movement seems to have been a sudden one. "The surface of the land before this (Oamaruvian) transgression is known to have been of very low relief,—*i.e.*, a peneplane—and the attainment of such a surface demands a period of standstill of the strand line." (Dr. Thomson, 1920, p. 411). The result was that a great sheet of conglomerates and quartz grits spread over the eroded surface of the Pre-Notocene rocks. Lagoonal conditions seem to have occurred and a flora flourished in the higher parts. These conditions lasted long enough for several feet of brown coals to be accumulated. The surface of the land appears to have fluctuated above and below sea-level, for coal seams are found at different horizons.

The sea now began to advance, and the marine beds of the Oamaruvian system were laid down. Over the fluvio-marine sands of the coal-measures greensands were deposited while the submerged area still formed a continental shelf.

The lower greensands contain a moderately rich molluscan fauna. After a considerable thickness of these beds had been deposited a period of standstill occurred, and the upper part of the greensands became phosphatized. This period seems to have been of some duration since the succeeding upper greensands contain a markedly different fauna from that which preceeded it.

These greensands become marly in their uppermost parts. In the sequel it will be shown that both series of greensands are best referred to the Bortonian stage of Park.

At McCulloughs Bridge the upper greensands are followed conformably by the Ototaran limestone but a marked palaeontological break is concealed. The whole of the Waiarekan tuffs are completely missing. It seems necessary to postulate local uplift during this time. With the transgression of the succeeding Ototaran sea glauconitic limestones were laid down. These beds are poor in mollusca but contain brachiopods and echinoderms.

It is clear that the deposition of the Oamaruvian limestones was not uninterrupted, because there is a phosphate band between the lower and upper parts of the limestone in the area. Dr. Thomson has shown that this contact is similar to that between the Ototara stone and the Hutchinson Quarry greensand; and to that between the Amuri limestone and the Weka Pass stone. For these three cases "a similar cause, viz., a sudden shallowing of the sea, followed by a period of standstill" (1920, p. 411) is suggested. However, such palaeontological evidence as is available shows that these three phosphatic layers are not of the same age. The limestone is considered to be laid down at the depth of maximum submergence. It is, however, of fairly shallow-water origin, and hence the depth of this sea cannot have been so great as that from which the Amuri limestone was deposited.

A further period of stand-still took place at the end of the Ototaran stage, for the junction between the limestone and the over-lying Hutchinsonian beds is marked by a band of rolled shells.

Later sedimentation continued in a shallower sea and blue clays (and locally greensands) were formed. A distinct brachiopod fauna. shows that rapid evolution or else a migration of forms occurred. As the sea retreated the clays gave way to more sandy beds forming the Awamoan stage. The brachiopod fauna became extinct or could not live in such shallow water, but its place was taken by a new molluscan fauna very distinct from that which inhabited the Bortonian sea.

The absence of Wanganuian marine sediments in South Canterbury and the increasingly coarse nature of the later Awamoan beds suggest regression of the sea at the end of the Awamoan stage. At some time during the "Pliocene" or early Notopleistocene extensive block faulting occurred—the Kaikoura deformation of Dr. Cotton (1916). Whether or not the older gravels of the district were formed before or after this orogeny cannot be inferred from any evidence found in the area mapped. The Notocene beds were tilted mainly to the south during these movements. The elevation of the land thus brought about was associated with the Pleistocene glaciation. As the ice retreated, rock-waste from the glaciers was carried away and spread over the foot-hill areas by streams. This material was dried, and subsequently was blown by the wind to be laid down as an extensive loess deposit.

Since the Kaikoura movement the uplifted blocks of Notocene rocks have been eroded away for the most part and there remains of this formerly extensive covering sheet only the remnants which were preserved in down-faulted areas. Considerable changes in drainage must have occurred, for an example of stream piracy is illustrated by the Waihao Gorge.

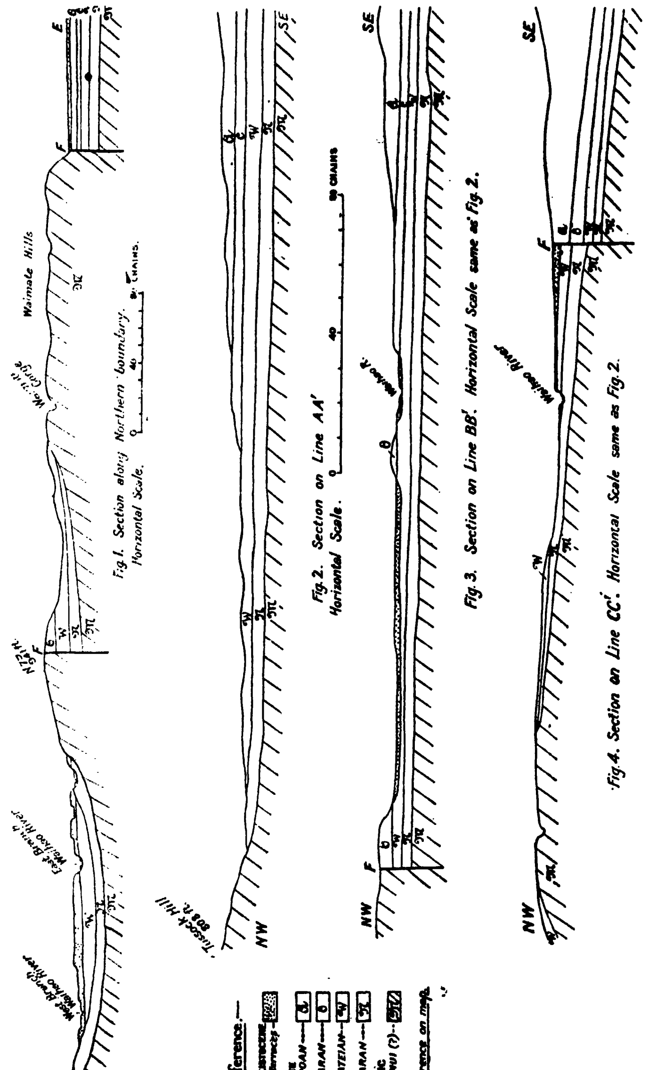
In more Recent times the strand seems to have shown a tendency to rise relatively to the sea. This is shown in the entrenched course of the Waihao River, and in the formation of four major cycles of terraces formed at increasing heights above the present stream-level.

STRUCTURE.

The Notocene rocks in the Waihao area, and in the adjoining Waitaki Valley, are found in long narrow depressed areas. To explain this fact, most of the older geologists except McKay, and in particular von Haast and Hutton, conceived the idea that the beds were laid down in long narrow embayments in the early Tertiary coast-lines. This view was accepted by Suess (1906). "Modern workers (e.g., Cotton, 1913, 1916, and Speight, 1915, p. 153) confirm McKay's view (1892) that these narrow intermontane strips of younger rocks are but dislocated remnants of more extensive sheets which, at one time, covered nearly all of the area that is now New Zealand" (Benson, 1922, pp. 40-41).

The abundance of quartz pebbles in the coal-measures at Waihao supports the view that these beds were formerly more extensive. Although the limestone is probably of shallow-water origin, the nature of the marine beds as a whole shows that they could hardly have been deposited in a narrow trough-like basin where terrigenous sediments would almost certainly have accumulated in some bulk.

The structure at Waihao supports the view that uplifted blocks, e.g., the Hunters Hills, have been denuded of their Notocene sediments and that now these sediments are found only in down-faulted regions. In discussing part of the Waihao area outside of that here



mapped Dr. Thomson remarks: "The disposition of the Tertiary beds at Waihao favours McKay's view, for the basal surface of the coal-measures is not plane, but gently curved, so that their outcrop is roughly semicircular between Elephant Hill and the Waimate Hills, while a minor basin occurs north of Tussock Hill in such a manner

that it cannot be explained by original deposition. Further the great fault along the north-east side of the Waimate Hills is evidence of differenial movement since the deposition of the Tertiary beds" (1915, p. 160).

Sections across the area mapped are given to show that the structure of the area accords with the views expressed.

PHYSIOGRAPHY.

The topographical features of the area may be broadly considered as a belt of low country forming the lower Waihao basin separating two higher masses; the Waimate Hills and part of the Hunters Hills on the north side, from the Waikakahi downs on the south.

The Hunters Hills, from which Tussock Hill projects, and their easterly continuation, the Waimate Hills, form the eastern portion of a strong range which diverged from the Southern Alps and runs south as the Two Thumb Range, with peaks over 8,000 feet in height. Inland from Waimate this range divides, one branch continues south towards the Upper Waitaki valley as the Kirkliston range, while the other turns to the east, as the Hunters Hills. Facing Waimate and for a distance of 6 miles it presents a straight steep front which Dr. Cotton has noted as probably a fault line scarp. This range is truncated by the Lower Waihao River and further east is separated from the sea by the southern extension of the Canterbury Plains.

The Waimate Hills are cut off from the Hunters Hills by the Waimate Gorge, which is the most interesting topographical feature found in the district. It represents an old gorge cut by the Waihao River. McKay (1882) and Dr Thomson (1915) have both shown that this gorge has been the result of stream piracy. Two hypotheses might be suggested to account for it. One, it may be simply the result of the capture of the Upper Waihao by a small stream working up from the East; or, two, it is possible that after cutting the gorge to its present level the Waihao River may have been blocked by the last stages of the uplift of the Hunters Hills thus finding a readier outlet through the softer Notocene rocks beyond the end of the greywacke block further to the southeast. It might, of course, be due to a combination of both these factors. The former of these hypotheses seems to account for the phenomenon more simply. The river where it cut the gorge must have been established in that part of its course before the Hunters Hills block arose, i.e., it must have been an antecedent (or ante-consequent) stream.

The greywacke through which the gorge is cut is much more resistant than the Notocene sediments, and erosion of it must have been very slow. While this erosion was in process the upper Waihao area was reduced to a mature topography. A stream cutting back through the relatively soft rocks of the lower eastern area would progress comparatively quickly, and eventually capture was effected somewhere near the present site of Waihao Forks. Once capture was accomplished the stream was rejuvenated and easily deepened its beds and formed gorges through the old flood-plain. The tributaries became renewed in vigour, with the result that gorges now modify the mature slopes of the Hunters Hills. The fault which crosses the river at the

lower gorge of the Waihao may have accentuated the activities of the small capturing stream, for the downthrow side is to the east, and if this fault preceded the capture it would have acceleraed the cutting-back process which occurred.

McKay (1882) has shown that the present drainage of the Arno terrace, almost from the banks of the Waihao still flows out to sea by the Waimate Gorge. This fact seems to negative the hypothesis that the tail-end of the uplift of he Hunters Hills caused the abandonment of the gorge. If this had been the case it seems reasonable to suppose that the water would have flowed north through the gorge until either end of it or one particular part of it, acted as a barrier. Then the water on the south side of this barrier would flow south across the Arno terrace to join the Waihao—a deduction not borne out by fact.

The Arno terrace represents part of the flood plain of the Waihao when it flowed through the gorge and McKay states "the banks of the old river-channel may in places yet be observed." (1882, p. 85.) The writer could not trace any old river bed, but the present relief seems to indicate that capture was effected at a spot just below Waihao Forks.

The southern mass of this area comprises the part of the Waikakahi downs, which have a breadth of six to nine miles between the Waihao and Waitaki Valleys. The highest point is Mt. Harris—927 feet above sea level. This is composed almost entirely of Awamoan beds forming downs country with mature topography. The streams are short and have little volume, but have cut gorges through the limestone just before entering the Waihao.

The largest part of the district forms the lower basin of the Waihao River. This river rises on the western slopes of the Hunters Hills, and in the upper part flows through gorges cut in the greywacke. At the Forks it receives a large tributary which drains the hills forming the watershed between the Waihao and Hakataramea Rivers.

The lower part of the stream passes in narrow gorges through the limestone formation, below which it opens out again only to be restricted between the east part of the Waimate Hills and the Waikakahi Downs. It then enters the alluvial plains and passes out to sea.

Above the Forks the river shows a meandering course and is deeply entrenched. Terraces are beautifully developed. Many irregularities in the terrace-formation are found, but generally any one terrace can be referred to one of four major terrace groups. The writer has attempted to map these different terraces, but no definite correlation over the whole area is claimed.

In the first series all terraces up to 20 feet above stream level have been mapped together. This group of terraces has a wide occurrence. In the east of the area is formed a wedge-shaped flood-plain now dissected by the river banks; this continues as the lower Canterbury Plains. From the lower gorge to McCullough's bridge a similar terrace has a wide development. It can thence be traced upstream and is particularly clear in both branches of the Waihao, and has been cut in the greensand. It appears on one side or the other of the

meandering entrenched stream as it swings to the north or south. In the South branch a pretty example of a cut-off meander is found on the surface of this terrace.

The second series of terraces is at a height of approximately 60 feet above stream level in both branches of the Waihao. The village of Waihao Downs is built on this level.

The third terrace at 90 feet above stream level has a wide extent known as the Arno plain. It continues up the North branch of the Waihao and is clearly differentiated from the lower 60 foot terrace. It is again seen up the South branch but here the development is not so perfect.

The fourth and highest terrace is found between the branches of the Waihao. It is 120 feet above stream level.

Other physiographical features of interest are the fossil-plain forming the Western slopes of the Hunters Hills (Cotton, 1922) and the prominent fault-line escarpment North of Waihao Forks.

DETAILED STRATIGRAPHY AND TABLE OF CLASSIFICATIONS.

PRE-NOTOCENE ROCKS.

These rocks, which are greywackes and argillites, form three elevated parts of the district along the north boundary of the area. These are the Waimate Hills (an upraised block north of Waihao Forks), part of the Hunters Hills, and Tussock Hill which rises to a height of 808 feet. No variation in lithological character is seen in any of these three parts mapped.

These beds formed part of the Waihao Formation (Silurian) of von Haast (1879), the Maitai and Te Anau Series (Carboniferous and Upper Devonian) of McKay (1882); the Te Anau system (Carboniferous) of Professor Park (1910) and the Maitai Series (Trias-Jura) of Dr. Marshall (1912).

The beds dip at high angles and strike in a north-west direction. They are characteristically unfossiliferous, and are succeeded with great unconformity by the Notocene sediments.

In describing these rocks in the Hunters Hills and in the southern spurs, the Waimate Hills, McKay states "the rocks.... are mainly coarse grey, very hard sandstones, slaty breccias, and dark-blue, almost black, slates. The strike of the beds varies considerably, as a rule a little to the west of north, the dip being westwards at angles 60° to 85°. At various places in the more slaty beds indications of fossils were discovered" (1882, p. 78).

Age and correlations—The writer has found no evidence by which any correlation could be made, but follows Dr. Marshall (1912 and 1918) and Dr. Benson (1921) in placing these beds in the Permian-Trias-Jura Series.

TABLE OF CLASSIFICATIONS.

Sequence of beds with local names.	von Haast, 1879.	McKay, 1882.	Hutton, 1887.	Park, 1918.
a. Sands and gravels *b.* Loess. *c.* Older gravels.	Recent and quarternary.	Recent to Pliocene.	——	——
Clays and sands. "Mount Harris beds."	Pareora Formation. (U. Miocene or L. Pliocene.)	Pareora Formation. (L. Miocene).	Pareora Formation. (Miocene).	Awamoan.
Blue Calcareous Clays.	Not recognised.	Not recognised.	——	Not recognised.
Glauconitic limestones. "The Waihao Limestone."	Oamaru Formation. (Upper Eocene) or Lower Miocene).	*a.* Ototara limestone *b.* Chalk-marls	Oamaru Formation. (Oligocene).	Upper Hutchinsonian.
Greensands. "Waihao Greensands."		*c.* Marly greensand *d.* Island Sandstone	Pareora Formation. (Miocene).	Lower Hutchinsonian. Ototaran† Waiarekan
Coal-measures.		*e.* Coal beds.*	——	Ngaparan
Greywackes and argillites, etc.	Waihao Formation. (Silurian).	Matai and Te Anau Series (Carboniferous to U. Devonian).	——	(1910) Te Anau Series (Carboniferous).

*Cretaceo-Tertiary.
†The writer is not clear exactly what beds at Waihao Professor Park places in the Ototaran Stage.

TABLE OF CLASSIFICATIONS (Continued).

Thomson 1916 and 1920.		Marshall.	Morgan, 1922.		The Writer, 1923-24.		
Notopleistocene.		—	—		Notopleistocene.		
a. Awamoan (Upper Miocene)	Notocene		Awamoan.	(Miocene to Oligocene)	Notocene	*a.* Awamoan	"Miocene"
Not recognised.			—			*b.* Hutchinsonian	
b. Ototaran (Lower Miocene)			Ototaran			*c.* Ototaran	"Miocene" or "Oligocene"
c. Waiarekan (Oligocene)		(1923) Upper Eocene	Waiarekan			*d.* Waimateian: 1. Tahuian, 2. Bortonian	"Eocene"
d. Ngaparan.			Ngaparan			*e.* Coal Measures.	
		(1912) Matai series (Trias-jura).	—		Maitai Series (Permian to Jurassic).		

Coal Measures.

The coal-measures are found at three localities in the district, viz., an extensive outcrop bordering the south slopes of the Waimate Hills; a restricted occurrence developed in a small creek which enters the North Branch of the Waihao, about a mile upstream from the Forks; and a third exposure overlapping on to the base of Tussock Hill, in the north-west of the area. These three occurrences will be described in the order given.

Where the river impinges on the south flanks of the Waimate Hills, the coal-measures form high cliffs. The base of the series is not exposed, and the lowest beds visible are coarse quartz conglomerates. Alternating with these are carbonaceous layers and bands of fine quartz sands which are pure white in colour and very fine grained. Thin bands and lenses of quartz pebbles, the latter showing frayed ends, are common. In these thinner quartz bands the average size of the rounded pebbles is about ½ an inch; they are usually clear white but may be smoky.

The higher beds are quartz sands, containing carbonaceous layers and hard bands of brown iron-stained sandstones. The whole series appears to be unfossiliferous.

In a small creek which cuts through the cliff slightly lower beds are found—black coaly grits, dipping at 12° in a direction 172°S. They are succeeded by white quartz sands.

The beds here appear to have been laid down on a sloping surface of an old shore-line.

In the development found in the North branch of the stream the coal-measures appear to pass beneath the greensands. In the road-cutting where the road descends on to the low river-terrace, some 40 feet of the coal-measures are found. They dip 12° in a direction 210°S. The lower 35 feet is made up of coarse quartz grits and finer sandstones, which alternate in irregular thicknesses. The shaly layers are intercalated with thin seams of coal up to ½ an inch in thickness. The sandstone layers are well banded. Above, the beds are noticeably coarser and consist of relatively large, rounded, quartz pebbles set in a sandstone matrix. This band, unlike the sandstones, is not cemented, but crumbles easily. Following this is some 3 feet of carbonaceous sands with quartz pebbles—the coaly facies is banded with fine lamellae.

On the west side of the mouth of a small gully which enters here the coal-measures are again exposed. This time they are much more carbonaceous and a black tinge colours the quartz sands. Four bands are noticeably carbonaceous — the lowest being the thickest and developing into a poor lignite some 4 feet in thickness. It has apparently been tried for burning, but the size of the excavation would suggest that this was not a success. Higher up the creek the quartz sands rest on the older greywacke, which is light in colour and leached to a considerable depth by the effects of the oxidation of the iron sulphides contained in the coals.

Still further upstream the basal bed is a highly cemented ferruginous conglomerate of large angular greywacke boulders, with a matrix of quartz pebbles and iron oxides. The greywacke below is completely rotted and resembles very closely the normal sandstone above.

However, gradations can be traced between the altered surface and normal greywacke, while concretionary weathered boulders show a solid kernal.

The third development of these beds is found below Tussock Hill. They are well exposed on the south side of the creek which flows below Tussock Hill to enter the south branch of the Waihao. This exposure is not in visible contact with either the greywacke or the greensands.

The upper four feet are of reddish-brown sands containing large pebbles of greywacke. The lowest part of this band consists of a conglomerate ranging from 6 inches to several feet in thickness and made up of irregular blocks of greywacke set in a matrix of rolled quartz pebbles, the whole being strongly cemented and stained yellow and red with iron oxides.

Below this comes some 40 feet of white quartz sands, well bedded in places. Lenses of inferior coal and carbonaceous material were observed at different horizons.

In the area mapped no coal-seams of workable thickness form surface outcrops, but several shafts have been sunk and a fairly good coal is utilised for local consumption. Dr. Thomson, 1915, publishes 13 analyses of coals from the district; these are quoted below:—

1	2	3	4	5	6	7	8	9	10	11	12	13
34·72	27·77	35 85	32·83	24·81	27 78	27.97	39·41	38·42	22·0	24·95	24·28	28·37
22·83	31·06	43·02	47·24	54·41	49·84	31·06	28·40	29·53	52·8	36·41	36·16	43·22
28·01	36·18	15·01	16·32	17·58	18·19	36·18	23·96	24 21	15·9	26·09	30·59	23·49
14·44	4 99	6·12	3·61	3·20	4·19	4·79	8·23	8·02	9·3	12·55	8·97	4·92
4·5	3·6	4·30	3·90			3·6						
										1·62	1·78	2·98

1. Waihao. Coal water-logged, but dried as powder for 48 hours. Average of four samples, 20th Ann. Rep. Col. Lab. (1886), p. 39.
2. Waihao. Ash contains alkaline carbonates. 21st Ann. Rep. Col. Lab. (1887), p. 35.
3–7. Waihao. 27th Ann. Rep. Col. Lab. (1893), pp. 21-22.
8, 9. Waihao Forks. 30th Ann. Rep. Col. Lab. (1897), p. 4.
10. Shale, Waihao Forks Coal-mine. 39th Ann. Rep. Col. Lab. (1906), p. 5.
11. Waihao Coal-mine. Rep. Analyses N.Z. Coal, etc., Mines Dept. (1907), p. 9.
12. Waihao Forks. 44th Ann. Rep. Dom. Lab. (1911), p. 9
13. Elephant Hill Coal-mine. Collected by Dr. Thomson and analysed by Dominion Analyst, 1913.

The average composition of Waihao Coals calculated from the above table is as follows:—

Fixed Carbon	29.92
Hydrocarbons	38.92
Water	23.98
Ash	7.18

Dr. Thomson concludes, "These analyses show that the Waihao coals are of poor quality, being too low in fixed carbon, rather high in ash, and exceedingly high in water." (1915, p. 161.)

The abundance of rolled quartz pebbles in the coal-measures leads to interesting speculations, since they could not have been derived from the greywacke with which most outcrops are in contact. Hence it is surmised that before block-faulting took place, the coal-measures were of much greater extent, and, in company with the overlying beds, formed part of an extensive covering-stratum. It is only where the Notocene beds now occur in down-faulted areas that they have been preserved. The nearest source from which the quartz could be derived is the quartz-mica-schists of Central Otago, and hence they must have been carried a considerable distance, a conclusion which is borne out by the rounded nature and more or less uniform size of the pebbles themselves. However, when the quartz sands were laid down they must have been close to an eroding surface of greywacke, for angular boulders of this rock are common in the basal conglomerates.

Correlation:—The lack of fauna in these beds makes correlation difficult. However, they correlate lithologically with the coal-measures developed in other Oamaru localities, particularly with similar beds at Ngapara, Wharekuri, Pareora and Kakahu.

These beds have hitherto been referred to the Ngaparan Stage of Dr. Thomson, but this term has no exact time-significance. It may, however, be retained to denote a land or coal-measure facies which may range from Kaitangatan to Waiarekan in age. The age of the Waihao coal-measures is probably basal "Eocene."

Waimateian Stage.

The rocks placed into this stage are in ascending order:—

1. Hard sandstones and conglomerate with concretionary structure. The "Island Sandstone" beds of McKay.
2. Lower greensands with an upper phosphatic band.
3. Upper greensands.

In a paper read before the Adelaide Meeting of the Australasian Association for the Advancement of Science, 1924, the writer (1926, p. 324) has shown that the lower part of these beds is most fittingly correlated with the Bortonian Stage of Professor Park. Therefore the Waimateian stage has been subdivided into: A. The Bortonian substage which includes 1 and 2 above; and B. The Tahuian substage, including the upper greensands.

The reasons for the above innovations are briefly as follows:—
Up till the present these greensands have been referred to the Waiarekan Stage of Dr. Thomson.

Recently Dr. Marwick, 1926, p. 307 *et seq.* has described the hitherto unknown fauna of the beds of the Lorne district in the Waiareka Valley, upon which the Waiarekan Stage is based. His work shows clearly that the fauna of the Waiarekan tuffs is very distinct from that of the typical Bortonian, therefore he restricts the term Waiarekan to the tuff-beds. Now Professor Park's Bortonian substage is based on the Lower Waiarekan beds in the Waitaki Valley and it is with these beds that the fossils from 1 and 2 are most allied.

The fossils of the Borton's Beds, the type locality, are very poor, being for the most part casts. Thus it is from the Waihao area, where the sequence is clear and where the beds are productive of numerous well-preserved fossils, that a palaeontological basis may be given to this stage.

The lowest bed exposed in this section forms a ledge which the greensands higher in the sequence and seem lithologically to be the closing facies of the coal-measures. However, since they contain the first marine fauna, they appear to mark the first advance of the succeeding marine conditions.

They outcrop at one place only—on the right bank of the Waihao River about four miles East from Waihao Forks. These beds formed the "Island-sandstone" of McKay, 1882.

The lowest bed exposed in this section forms a ledge which crosses the river causing a rapid. It is very hard and silicious, being studded with quartz pebbles. Concretionary structures are beautifully developed. Some of these have been weathered out to leave large cup-shaped basins with a shell-in-shell structure. These occur up to 4 feet in diameter.

This band is followed by 6 inches of a poorly fossiliferous quartz conglomerate. Both these beds strike at 210° and dip at an angle of 5°. Calcareous worm-tubes are very abundant in places at this horizon. The succeeding beds are black carbonaceous grits, with quartz pebbles and a pungent odour. Still higher the beds appear to be slightly glauconitic. The sequence is capped by 12 feet of river gravels.

Fauna: The molluscs collected were for the most part fragmentary and very poorly preserved. Shark's teeth are present.

Forms worthy of specific determination were:—

Notoplejona n. sp.
Marshallena uttleyi (Allan).
Clavatula mackayi Suter.

Other generic determinations include:—

Acteon ? sp.
Natica sp.
Ostrea sp.
Phos ? sp. cf. *P. ordinarius* Marshall.
Turritella sp.

Dr. J. Marwick notes the following forms:—

Sinum fornicatum Suter.
Uber (*Euspira*) *firmus* (Marwick).
Turia sp.

Suter cites some further species from the locality in *N.Z. Geol. Surv. Pal. Bull.* No. 5, (1917):—

Euthriofusus spinosus Suter.
Fulgoraria (*Alcithoe*) *biconica* Suter.
Harpa (*Eocithara*) *neozelanica* Suter.
Lapparia hebes (Hutton).
Rapana waihaoensis Suter.

The lower greensands proper, or the Bortonian beds, are typically developed in the fine natural sections in the river-cliffs opposite Waihao Downs. Greensands, generally, have a wide distribution in the area and have been mapped as a whole. Owing to the fact that these beds are fossiliferous in few localities it is extremely difficult to assign any particular outcrop to either of the two substages. For this reason the greensands will be treated as a unit, and finally the type-localities which are richly fossiliferous and on which the substages are based will be described. For the most part the greensands are covered by Pleistocene gravels, but are well exposed in many fine river-cliffs and terraces.

Near Waihao Forks these beds are clearly seen on the river banks and in the railway cuttings as one approaches the Forks from Waimate. Following downstream the greensands outcrop on both sides of the river, at first prominently, but later the development is restricted to small exposures below limestone cliffs. The actual contact is obscured by river gravels and limestone talus.

At McCulloughs Bridge, about three miles East of the Forks, the greensands are well exposed by river erosion, and the only contact with the overlying limestone in the district is clearly seen. This section is the type one for the Tahuian substage, and will be described in detail in the sequel.

Below McCulloughs Bridge the Greensands appear again on the north side of the river. From here they pass away towards the Waimate Hills, making a bold escarpment. Their contact with the coal-measures (or with the greywacke?) is obscured by ploughed paddocks.

West of the Waimate Gorge greensands again appear either overlapping the greywacke or faulted against it (the crucial evidence could not be obtained) and they appear to pass under the limestone.

The structure of the area between this limestone and the Waimate Hills would lead one to believe that the gravels forming the Arno Terrace act as a thin covering to the greensands series. This hypothesis is borne out by cuttings in the railway line between McLeans Railway Station and the Forks.

Commencing again at Waihao Forks one can trace the greensands, as cliff-faces, up both branches of the stream. Further, all the area enclosed by these branches is covered by a gravel veneer overlying the terraced surface of the greensand. Following first

the north branch of the Waihao one sees the greensands on both banks of the meandering stream, but these do not call for special mention except that they are practically unfossiliferous. In the second big bend of the river to the north, where the road crosses the low-lying gravels, the coal-measures are seen to pass beneath the greensands. The lower parts of the latter are more coarse grained, tending to be concretionary, and show marked iron staining. They are again unfossiliferous.

Between the road from Waihao Downs to Waihaorunga and that from the Downs towards Elephant Hill greensands have a wide extension. The country is of rolling downs and few outcrops are to be seen. In places clays and gravels hide the rich soil derived from the greensands so that their boundaries cannot be traced with certainty.

A further greensand-outcrop is of special interest. It occurs in the extreme east of the area where the Waihao River leaves its gorge and enters the alluvial plains. McKay, 1882, describes the sequence there developed and gives a section.

"The marly greensands are overlaid by dark foraminiferous clay-marls, containing one or two thin bands of decomposed tufa. This is overlain by a tuffaceous fine-grained breccia-conglomerate, and this, in turn, by a marly calcareous greensand. Where these beds rest on the marly greensand they dip east at a comparatively low angle, but the dip rapidly increases, till the breccia conglomerate is found standing almost vertical; and the higher part of the beds have a decided dip in the opposite direction, and are seemingly underlain by the fossiliferous Pareora (Mt. Harris) beds, which show in the banks of the River a westerly dip." (1882, p. 71.)

McKay further points out that the higher beds are highly fossiliferous, the variety of species being considerable. With this view the writer cannot agree. A careful search was made for fossils, but only a few corals and some fragments of brachiopods could be discovered. A fault is postulated to explain the contact of the Mt. Harris beds with the greensands. McKay, 1882, was of the opinion that the higher beds of the greensand series found here were the time-equivalents of his "chalk-marls" or the lower limestone, and that the volcanic action which gave rise to the tuffaceous beds would stop the deposition of limestone. However, in his later report he rejects this hypothesis. The limestone is missing from the section.

It now remains to discuss the type localities of the two substages of the Waimatean. The Bortonian substage is represented by the exposures displayed in the river-cliffs at Waihao Downs.

Commencing at the Forks and following up the south branch one sees some fine exposures. The greensands form high cliffs and are richly fossiliferous in a few places. The sporadic occurrence of fossils in the greensands is a noteworthy feature. In the first bend upstream from the railway bridge steep cliffs form the left bank, while the right bank is little above stream level and shows a thin veneer of gravels over an eroded surface of greensand. The strike of the beds is 98°E and they dip at low angles up to 6° to the south, obviously passing under the limestone escarpment facing north

along the railway line. The lowest beds are dark bluish-green in colour and fairly soft and friable. Bands of rounded concretions occur at some four or five horizons, but only the lowest band, fifteen feet above the creek at the head of the bend, is well developed. The boulders project from the cliff-face and from the majority of the talus with which the base is littered. These concretions, which are up to two feet six inches in diameter, often contain fossils, but they are difficult to extract in a complete state. *Limopsis* is abundant, and is associated with *Venericardia, Cucullaea,* and *Pecten.* Worm-borings are common in the lower bands, and calcareous worm-tubes were found abundantly in one concretion.

The upper parts of the cliff are inaccessible, but there appears to be a decided difference in lithological characters between the upper and lower greensands. The former are much lighter in colour and seem to resemble the facies forming the fossiliferous rocks at McCulloughs Bridge. This band appears to be about thirty feet in thickness, and is capped by twelve to fifteen feet of coarse gravels.

Continuing upstream one finds a similar lithological series clearly shown in the second great bend to the north. Here at one small exposure marked "fossils" on the map, an excellent molluscan fauna was collected. This collection is taken as typical of the Bortonian beds. The forms from this spot show many differences from those occurring at McCulloughs Bridge. The shells are rather fragile but the matrix is soft and disintegrates easily. *Limopsis* is again very plentiful.

Near the north-east corner of the area a small creek enters on the right side of the south branch of the Waihao. The lower greensands are well developed here and can be traced down, as one goes upstream, to the coal-measures beneath Tussock Hill. These beds are here rather coarse-grained and inclined to be gritty, containing as they do many small rounded quartz pebbles and small tubelike iron concretions. Small plates of mica give the rock a noticeable glitter. They are unfossiliferous, and at the base strongly cemented with iron oxides which give a reddish tinge to the beds. They strike 45°E and dip south-east at an angle of 6°. Further upstream the coal-measures appear and seem to dip beneath the greensands.

From Waihao Downs it was once proposed to continue the railway line toward Waihaorunga. However, the scheme was dropped but not before some fine cuttings had been made through the greensands on the south side of the river. Above the Downs (Farm) Station these beds are fossiliferous—Limopsis being particularly abundant. The variety of forms here is very limited, and is in marked contrast with that of the more highly productive beds of apparently the same horizon which occur in the field only about a quarter of a mile distant.

The greensands are seen in the road-cuttings near the Downs Station. They are overlain by twelve feet of old river gravels which are in turn followed by nearly forty feet of loess and clays. The loess beds are very similar to those found near the breakwater at Cape Wanbrow, Oamaru.

The fauna of these beds is as follows:—

Antigona n. sp.
Architectonica marwicki Allan.
Austrofusus (*s. str.*) *acuticostata* (Suter).
Baryspira morgani (Allan).
Carinacca allani Marwick.
Cirsostrema cf. *lyrata* (Zittel).
Clavatula mackayi Suter.
Colus bensoni Allan.
Cucullaea waihaoensis Allan.
Cymatium decagonium Finlay.
Dentalium n. sp.
Dentalium n. sp.
Friginatica prisca (Marwick).
Galeodea aff. *senex* (Hutton).
Globisinum cf. *elegans* (Suter).
Hemifusus goniodes Suter.
Insolentia laciniata (Suter).
Insolentia mordax (Suter).
Insolentia (?) *sertula* (Suter).
Latirus (*Peristernia*) *neozelanica* (Suter).
Limopsis campa Allan.
Marshallena serotina (Suter).
Mauia curvispina Marwick.
Monalaria concinna (Suter).
Notoplejona necopinata (Suter).
Ostrea mackayi Suter.
Pecten devinctus Suter.
Pecten huttoni (Park).
Pecten waihaoensis Suter.
Perissoptera (*Hemichenopus*) *thomsoni* Allan.
Rapana neozelanica Suter (cast only).
Speightia spinosa (Suter).
Spirocolpus waihaoensis (Marwick.
Turricula antegypsata (Suter).
Venericardia acanthodes Suter.
Waihaoia thomsoni Marwick.
Waimatea inconspicua (Hutton).
Zemacies cf. *torticostata* (Marshall).

An analysis of this fauna shows several important facts. Thirty-eight species, including nine new species, are recorded. No Recent species are present, indicating that the beds are probably of "Eocene" age. It is remarkable that the oldest Tertiary beds in New Zealand, viz., the Wangaloan Series, have no species in common with this fauna. In consideration of this fact, and also of the fact that the overlying beds have likewise no Recent species, perhaps "Middle Eocene" would be most appropriate.

When compared with the fauna of the Hampden beds seven speices (or 18%) of this Bortonian fauna are found to be common. Hence the relationship is not so close as is that of the Tahuian which has 27% or twenty species of its fauna in common with Hampden. The Bortonian then may be considered older than the Hampden beds.

A comparison with the overlying Tahuian fauna is of interest. Eight species or only 21% of the Bortonian fauna pass up into the Tahuian. Hence the faunas, although closely related in some respects, are really very distinct and seem perfectly to justify the subdivision proposed. Certain genera here present do not seem to occur in the Tahuian; the most noteworthy being:—*Notoplejona, Speightia, Hemifusus,* and *Perissoptera.* Certain species too are highly characteristic, and of these we may note *Mauia curvispina, Notoplejona necopinata, Speightia spinosa, Colus bensoni, Latirus (Peristernia) neozelanica, Monalaria concinna, Carinacca allani, Pecten devinctus,* and *Venericardia acanthodes.* Of the Turrids the *Turricula* group is abundant, being represented by six species whereas in the Tahuian only one is found. The absence of certain genera, such

as *Borsonia* and *Vexillum*, well developed in the Tahuian is equally striking.

Correlation:—Although the surface exposure of Bortonian rocks is limited the horizon appears to have a wide geograpical range in South Canterbury and North Otago. Tentatively the following beds may be grouped together into this substage:—The basal fossiliferous sandstone at Borton's, Waitaki River; the basal fossiliferous beds at Pareora; and the basal sandstone at Kakahu. The presence of this horizon is not yet proved at Ngapara, Wharekuri or Hampden.

The Tahuian beds are typically developed and are fossiliferous only at McCulloughs Bridge, in the Waihao Area. The section is capped by some eight feet of river gravels lying uncomformably on the bevelled surface of the limestone and greensands. Below this is a small wedge of the lower limestone, itself a calcareous greensand. It is here very fine-grained and light greyish-white in colour. McKay collected some rare foraminifera, but otherwise it is unfossiliferous. Next below this comes the uppermost part of the greensand series and exhibits, as it does further upstream, a marly facies, and is not fossiliferous. The contact between marl and limestone is sharp, but no erosion surface or angular unconformity could be observed. The marl grades down into a richly glauconitic greensand which is a rich chocolate-brown colour when freshly disturbed, but weathers to a drab grey with evidence of iron stainings. This band is some twenty feet thick and richly fossiliferous, the fossils being well preserved. Any one species is not abundant, but the remarkable feature is the great variety of forms, chiefly gasteropods, which one can obtain from the small section exposed. Mollusca are the most plentiful fossils, but corals, foraminifera, and brachiopods also occur. The coral is a pretty little cup-shaped structure but has not been identified. From comparison with figures in Zittel's Textbook (1913) the writer would suggest that this form is related to the genus *Trochocyathus*. *Nodosaria* was collected by the writer. The brachiopods were rare and are referred to *Thomsonica gaulteri* (Morris) by Dr. J. A. Thomson.

Below this again a hard, dark-green greensand is exposed which appears to be similar to the Lower greensands which are seen upstream from the Forks in both branches of the river. Speight and Wild (1919) comment on this lower facies and note a hard concretionary band, ten inches to twelve inches in thickness. "The upper part of this is bored with tubes, and shows irregular-shaped (phosphatic) nodules and borings in the upper layer, closely resembling those found in connection with the nodular layer of the Amuri limestone of North Canterbury." (1919, p. 185.)

In the identification of the species listed from the Waimateian the writer collaborated with Mr. H. J. Finlay, M.Sc., Otago University, and Dr. J. Marwick, M.A., Palaeontologist to the New Zealand Geological Survey. The writer acknowledges the debt he owes to these gentlemen for their help and kindness.

The mollusca of the Tahuian beds are enumerated below:—

Acteon n. sp.
Acuminia sulcata (Marshall)
Austrofusus (s.str.) *acuticostata* (Suter).
Amusium (Propeamusium) n. sp.
Baryspira morgani (Allan).
Architectonica ngaparaensis Suter.
Borsonia haasti Allan MS.
Borsonia huttoni Allan MS.
Borsonia verrucosa Allan MS.
Borsonia rudis (Hutton).
(?) Bullinella enysi (Hutton)
Carinacca haasti Marwick.
Carinacca waihaoensis (Suter).
Cirsostrema cf. *lyrata* (Zittel).
Claviscala (?) n. sp.
Cochlis notocenica Finlay.
Cochlis praeconsors Finlay.
Colus delicatulus (Marshall and Murdoch)
(?) Colus modestus (Marshall and Murdoch) (*nomen nudum*)
Colus solidus (Suter).
Coluzea climacota (Suter).
Conus (Conospira) tahuensis Allan.
Corbula pumila Hutton.
Corbula speighti Allan MS.
Cucullaea waihaoensis Allan.
Cymatium marwicki Finlay.
Dentalium n. sp. A.
Dentalium n. sp. B.
Dentalium n. sp. C.
Erato antiqua Marshall.
Eulima waihaoensis Allan
Friginatica prisca (Marwick).
Friginatica suturalis (Hutton).
Gemmula bimarginata Suter.
Gemmula complicata Suter.
Gemmula duplex (Suter).
Gemmula waihaoensis Finlay.
Gilbertia tertiaria (Marshall.)
Globisinum elegans (Suter).
Inglisella anomala (Marshall and Murdoch).
Latirofusus optatus (Marshall and Murdoch).
"Latirus" mysticus Allan MS.
Limea neozelanica Allan MS.
Limopsis waihaoensis Allan.
Marshallena formosa (Allan).
**Marshallena neozelanica* (Suter)
Marshallena spiralis (Allan).
Mitra hectori Hutton.
Nassicola cf. *costata* Hutton.
Notoseila attenuissima (Marshall and Murdoch).
Notacirsa elata (Suter).
†*Nuculana semiteres* (Hutton).
Nuculana solenelloides (Marshall).
Ostrea mackayi Suter.
Parasyrinx finlayi Allan.
Pecten cf. *chathamensis* Hutton.
Pecten huttoni (Park).
Pecten waihaoensis Suter.
Proximitra parki (Allan).
Proximitra (?) *plicatellum* (Marshall and Murdoch).
Triploca waihaoensis Marshall and Murdoch.
‡*Turbonilla hampdenensis* Finlay.
Turbonilla tahuensis Allan MS.
Uber (Neverita) pontis Marwick.
Uxia (?) *marshalli* Allan.
Waihaoia allani Marwick.
Waimatea apicicostata (Suter).
Waimatea inconspicua (Hutton).
Waimatea opima Allan MS.
Zaclys (*Miopila*) *tricincta* (Marshall).
Zeacolpus n. sp.
Zemacies aff. *marginata* (Marshall).
Zexilia crassicostata (Suter).
Zexilia waihaoensis (Suter).

**Daphnella neozelanica* Suter = *Belophos incertus* Marshall. For this and many other name changes and generic placings in this list, refer to Finlay. "A Further Commentary on New Zealand Molluscan Systematics," *antea* this volume.

†The type specimens of *Nuculana belluloides* Allan and *N. semiteres* Hutton are the same species, ancestral to the Recent *N. bellula* A.Ad., vide Finlay, *loc. cit.*

‡New name for *Turbonilla antiqua* Marshall, preoccupied; see Finlay, "New Specific Names for Austral Mollusca," *antea* this volume.

Seventy-five species are recorded, of which twenty-six are new to science. No Recent species are present. Taking the stratigraphical position and the above fact into consideration, the age may best be considered as "Upper Eocene." Forty-two species (including twenty-six new species) are restricted to this sub-stage.

Eight species, or 11% of the fauna, are common to the Tahuian and the Bortonian. It has already been shown that certain characteristic Bortonian species are absent. Twenty-eight genera of this list have no representatives in the Bortonian; the most noteworthy (having regard to the number of species in each genus) are:—*Marshallena, Borsonia, Corbula, Zexilia* and *Nuculana,* all of which have at least two species in the Tahuian. Of the Turrids (other than *Marshallena* and *Borsonia*) *Gemmula* (with four species) takes the place of *Insolentia,* and is accompanied by *Parasyrinx.*

The most characteristic species include:—*Baryspira morgani, Marshallena neozelanica, Borsonia rudis, Waimatea inconspicua, Zexilia waihaoensis, Colus solidus, Carinacca waihaoensis, Nuculana semiteres, Friginatica suturalis,* and *Spirocolpus waihaoensis.*

Of the beds outside the Waihao area the first comparison may be made with the fauna of the Hampden beds which has been made known to us by the enthusiastic and arduous research of Dr. Marshall, who has shown that that fauna is closely related to the one under consideration. He cites 44% of the forms as common to both localities. The writer, however, has found that only twenty species (or 27%) of the Tahuian fauna occur at Hampden also. In making this comparison, however, it must be understood that the personal equation in the species determination is an important factor. The writer is of the opinion that many of his new species occur also at Hampden, but unfortunately the Hampden forms have not been available to him for personal study. The nomenclature of these has not been since revised and the changes subsequent on revision of other lists during the past two years (the Hampden list though published in 1923, was prepared in 1921), have been considerable; it is thus not improbable that the same might prove the case in regard to the Hampden beds and might explain the apparent divergence in the figures noted above.

The species common to the Tahuian substage and the Hampden beds are:—*Austrofusus acuticostatus* (Suter), *Marshallena neozelanica* (Suter), *Zaclys tricincta* (Marshall), *Cirsostrema* cf. *lyrata* (Zittel), *Erato antiqua* Marshall, *Zexilia waihaoensis* (Suter), *Colus solidus* (Suter), *Gemmula waihaoensis* Finlay, *Gilbertia tertiaria* Marshall, *Globisinum elegans* (Suter), *Inglisella anomala* (M. and M.), *Carinacca haasti* Marwick, *Nuculana semiteres* (Hutton), *N. solenelloides* (Marshall), *Pecten huttoni* (Park), *Notoseila attenuissima* (M. and M.), *Acuminia sulcata* (Marshall), *Turbonilla hampdenensis* Finlay, *Gemmula complicatus* (Suter), and *Gemmula duplex* (Suter).

Dr. Marwick (1924) in his revision of the Naticidae does not give *Carinacca waihaoensis* (Suter) from Hampden; nor does he record *Friginatica suturalis* (Hutton); both of which (under *Ampullina*) were listed by Dr. Marshall. In this connection it seems advisable

to note the members of this family determined by Dr. Marwick, from Hampden. They are:—

Natica bacca Marwick;
Natica (*Carinacca*) *allani* Marwick (= *A. waihaoensis* of Marshall);
Natica (*Carinacca*) *haasti* Marwick (= *A. suturalis* of Marshall);
Globisinum elegans Suter may, perhaps be added, for it is listed by Dr. Marshall, and Dr. Marwick does not give localities.

The alterations entailed by the systematic work, however, do not invalidate, but if anything strengthen the conclusion of Dr. Marshall that the Tahuian beds of McCulloughs Bridge are most closely related to the Hampden Beds. They are here correlated.

It may be noted, however, that some of the genera, such as *Dicroloma* and *Trigonia*, which give a peculiarity to the Hampden beds, have not yet been found at Waihao.

In an attempted classification on a palaeontological basis of the strata near Oamaru, Dr. Marshall has proposed the Wharekuri Series, with 20–25% of Recent Species of Mollusca, and has suggested that the Waihao Greensands are probably to be placed therein (*Trans. N.Z. Inst.*, *51* (*1919*) *250*). He states "If the general relationship of this (Wharekuri) fauna and the percentage of Recent species can be taken as a guide it can be clearly shown that the horizon is lower than that of the Ototaran limestone and higher than the Bortonian of Park." (*loc. cit.* p. 242.) The writer has in preparation a revised list of the Wharekuri fauna (based on further collecting in 1924) and provisionally it may be stated that it has little in common with that of the Waihao greensands. On the other hand, its affinities with the beds above the limestone at Trig. Z., Otiake, are very marked.

With the Awamoan horizons the Waimateian of Waihao has little in common as far as the mollusca are concerned. The two are distinct,—a conclusion much at variance with that arrived at by Dr. Thomson and Dr. Uttley from a consideration of Suter's determinations. Some of the species whose range extends to the Awamoan may be noted. *Nassicola costata* (Hutton) (the type is from Mount Harris and this determination for the Tahuian shell is provisional); *Corbula pumila* Hutton (the type is from White Rock River and the species is common in Awamoan localities; again the determination is doubtful); *Pecten huttoni* (Park) (a third doubtful determination of a wide ranging shell); *Cirsostrema lyrata* (Zittel) (another wide ranging species which also occurs in the Waihao limestone and in the Mt. Harris beds); *Cochlis notocenica* (Finlay) (type from Awamoa—throughout the Oamaruian); and *Notacirsa elata* (Suter) (which has the holotype from Blue-cliffs).

Hence few species conflict with the dictum that the Waimateian fauna may be considered as a palaeontological entity. The great difference shown by the later Awamoan fauna may be explained in two ways. The first hypothesis is that the Awamoan fauna may

represent a new migration of mollusca. This suggestion seems uncalled for in the present state of our knowledge. While there is a marked specific dissimilarity the genera are in most cases allied or identical. The second hypothesis, and the one favoured by the writer, is that the period represented by beds between those referred to the Awamoan and those referred to the Bortonian or Waiarekan is of great duration and still imperfectly known. To add to the difficulty this period is the one during which the deposition of limestone has been at a maximum in the South Canterbury-North Otago area, with a resultant paucity of mollusca. However, the fossiliferous beds at Otiake and Wharekuri seem in part to fill the gap and with the stricter definition of species and the rejection of erroneous identifications from existing lists the ideal of a classification based on purely palaeontological lines seems within the realms of possibility.

It should be noted that the new substages herein proposed are based solely on the contained mollusca. In each case the characteristic mollusca have been cited, but this does not mean that these species are necessarily restricted to these substages; merely that the assemblage of species is characteristic and is worthy of recognition as such.

Correlation:—The Tahuian beds are correlated with the Hampden beds of Dr. Marshall. If present, they have not yet been recognised at Kakahu, Pareora, Borton's, Wharekuri, or Ngapara.

The study of this Bortonian fauna is considered to be important in that it helps to solve a problem which has not yet been considered by New Zealand geologists. It is this: Is there a gradual increase in age of the basal beds of the Notocene from Mount Somers, in the North, south through Kakahu, Pareora, Waihao, Waitaki, and Oamaru, down to Hampden and Shag Point; or are there separate Piripauan, Hampden, and Oamaruian transgressions with the basal Oamaruian beds the same age from the Kakanui River to Mt. Somers? This interesting problem, which Dr. Thomson pointed out to the writer, cannot be solved until the faunas of the basal beds at the various districts are completely collected.

The correlations herein suggested might be expected to throw some light on this problem. The Bortonian seems to succeed the coal-measures at Kakahu, Pareora, Waihao, and at Bortons, in the Waitaki Valley. Hence no increase in age of the basal beds can be cited over that area. At Oamaru, in the Waiareka Valley, and at Ngapara, the basal marine beds have been considered Waiarekan (see Park and Uttley); but Bortonian horizons seem to be indicated. At Hampden the Bortonian has not been noted, but the Tahuian is underlaid by some 1500 feet of Notocene sediments (McKay, 1887). Wilckens (1924) has shown that the basal beds at Shag Point are of Upper Senonian (Piripauan) age. At Wharekuri in the Upper Waitaki Valley the greensands are divisable into two lithological horizons. The higher is abundantly fossiliferous, and the age is certainly younger than either Bortonian or Tahuian. The lower greensands which overlie the coal-measures in Wharekuri Creek may prove to be Bortonian.

Hence it seems that in the South Canterbury-North Otago area the basal marine beds are generally Bortonian, but may in some cases be Waiarekan, the Hampden-Shag Point area being the single exception. Sedimentation then may be considered to have commenced in the Upper Senonian at Shag Point and with further submergence during the Tertiary the Oamaruian sediments overlapped on to the Piripauan beds and on to a surface of varied relief which extended from Shag Point to Mount Somers. The series at Hampden may conceal a break between Cretaceous and Eocene, but this has not been detected.

There seem then to have been but two transgressions during the Notocene in this area, the first Piripauan and the second Oamaruian. The second of these was discontinuous; the evidence being phosphate-bands at different horizons due to standstill conditions; local disconformity, e.g., as at McCulloughs Bridge; and interruption by volcanic activity.

OTOTARAN STAGE.

The Waihao limestone is here divided into three lithological zones—the whole being placed in the Ototaran Stage of the Oamaruian System. The threefold division seems to be fairly constant over most of the area mapped. The zones are in descending order:—

1. Fluted glauconitic limestone.
2. Nodular phosphate band.
3. Calcareous greensand grading into glauconitic limestone in the upper part.

The lower member forms the "grey-marl" of McKay (1882). Both Hutton and von Haast place this formation, the Waihao limestone, at the top of their Oamaru System. McKay (1882) places it in his Cretaceo-tertiary Series and correlates it with the Ototaran stone. Dr. Thomson (1916), Dr. Marshall, and others refer the Waihao limestone to the Ototaran Stage, while Prof. Park (1918), considers it to be Hutchinsonian. Thus all authorities are agreed with the single exception of Prof. Park.

The limestone occurs as a narrow strip running east from Waihao Downs along the stream for a distance of some five miles. Between Waihao Downs and Waihao Forks it forms a prominent escarpment which runs parallel to the railway. From the Forks bold and jagged cliffs follow the river bank. The cliffs are perpendicular in the upper parts but slope below into talus composed of large and small blocks of fallen limestone. The presence of this talus is unfortunate from the geologist's point of view since it completely obscures the junction of the limestone with the greensands below. The general strike of the beds is nearly east and west, hence practically the same horizon is exposed for the whole length of the outcrop. However, where small creeks enter the river, and where the talus accumulation is lower or has been cut away by the stream, the lower facies of the limestone is well exposed. Only at McCulloughs Bridge is an actual junction with the greensand observed and, as has been pointed out here, there is a clear cut

lithological separation with, however, angular conformity and no sign of an erosion surface.

The limestone continues south-west of Waihao Downs, but the escarpment is broken and the boundaries are difficult to trace with certainty. The beds appear to strike west-south-west towards Elephant Hill.

About two miles east of Waihao Forks an outcrop of limestone crosses the river, and for nearly a mile this horizon forms both banks of the river. This outlier extends for nearly one mile in a north-easterly direction. It has been extensively eroded and now lies, for the most part, as a great litter of broken blocks of all sizes.

A third mass, which for clearness, is here called the Fault limestone, lies to the north-north-east of the Forks, and is faulted against the secondary greywacke.

Detailed Sections:—Speight and Wild describe a section seen in an old quarry about three-quarters of a mile east of McCulloughs Bridge—in fact the most easterly part of the continuous outcrop. Their descripion is quoted in full.

"1. Whitish calcareous sandstone, quarried for building, and passing up into:—
2. Glauconitic sandstone, with nodules scattered through it, the upper part with passage beds into the overlying formation.
3. Limestone, marked by hard concretionary bands alternating with bands of more glauconitic character, which are softer. It is full of fossils, notably brachiopods and sea-urchins, and the limestone is largely made up of shell fragments. There is one distinctly marked layer of well-rolled shell fragments, with occasional rounded quartz-pebbles, and the beds below this are richest in nodules, some of which are based on fragments of bone, and some are almost pure phosphorite in appearance. Worm tubes are very evident in this layer." (1919, p. 185).

With this description the writer agrees but would suggest the following grouping of beds as being more natural and one which accords well with other sections in the area:—

1. Calcareous greensands or sandstones (i.e. Beds (1) and (2) of above are combined).
2. Phosphate band—comprising the nodular layer and shelly layer of above.
3. Fluted Upper limestone.

Some thirty feet of the lower beds are exposed. The upper six feet are more glauconitic and rich in fossils. Brachiopods are abundant (but were absent from the base of the section). Echinoid plates and spines are relatively plentiful. *Cirsostrema lyrata* (Zittel), and *Pecten huttoni* (Park) occur sparingly.

This is followed by some two feet of dark calcareous greensand—the nodular layer of Speight and Wild—rich in phosphatic nodules. Above this is some eight inches of a rolled shell-band composed chiefly of broken shells of brachiopods, and echinoderms. It is extremely hard and dark yellow when freshly broken. It weathers in a characteristic honey-comb fashion. It is followed by a fluted limestone—hard and soft bands alternating. The softer bands are noticeably more glauconitic and show signs of current-bedding. It is fossiliferous, containing similar forms to those of the lower beds. This upper limestone band can be traced

as a continuous escarpment as far as the huge fall of debris at McCulloughs Bridge and in fact continues from there with few interruptions and without much variation in facies as far as Waihao Forks.

The beds of this section dip south at a low angle (8°–10°). They appear to pass under the Mt. Harris Clays.

Further east of this quarry two small outcrops of the limestone are found. In a small creek some 200 yards further east, the phosphate shelly band is again exposed. Still further along the escarpment the lower sandstone appears and worm-tubes filled with glauconite were observed. These beds are then obscured by drift and clays derived from the overlying Mt. Harris beds.

From McCulloughs Bridge upstream as far as the second small creek east of the Forks the limestone forms prominent cliffs and the three-fold division holds good. The lower beds are pale greyish-green calcareous greensands and contain numerous brachiopods. Echinoderm fragments are common while as before *Cirsostrema lyrata* (Zittel) and *Pecten huttoni* (Park) are found. Foraminifera occur but are rare. Then follows the phosphate band— yellow in colour, and this is succeeded by the fluted limestone. The greatest development of the limestone facies occurs at about the middle of this line of section. Here the beds are considerably thicker than elsewhere, and appear to represent the rock formed at the time of maximum submergence. Between the ford over the Waihao and the second creek east of that, this fuller series is accessible. The upper greensands are exposed on the river bank—they are here very dark green and apparently rich in glauconite. These grade up into a few feet of marly rock which has a greasy feel. Its weathering is markedly different from that of the typical greensands. It breaks into small rectangular blocks with a conchoidal fracture, and is reminiscent of the Burnside marl developed near Dunedin. Immediately above this the sequence is obliterated by gravels and limestone talus. The base of the limestone, some fifteen feet higher, shows the typical lower calcareous greensand with its brachiopods and echinoderm fragments and spines. Here these grade into a fluted limestone very like that above the phosphate band. Some thirty to forty feet of this is present but unfortunately is inaccessible. *Dentalium* sp. was collected here. Slightly further east the upper parts of the cliff are accessible. The limestone described is followed by a more glauconitic bed (still below the phosphate band) which shows current-bedding. This, in turn, is succeeded by another banded glauconitic limestone, which is followed by some eighteen inches of bright yellow phosphate rock which again shows the honey-comb weathering. The lower part of the limestone is here almost twice as thick as that shown at the East and West extremities of the outcrop. The phosphate band is covered by some two feet of a very fine-grained rock which exhibits abnormal bedding. The deposition planes are distinctly undulose and suggest wave-scouring. It is quite distinct from the usual current-bedding of the upper beds.

Next comes the upper limestone, which is at first fluted but higher up apears to be a series of concretions set in a limestone

matrix. The concretions are up to eighteen inches in greatest length and are more ellipsoidal than spherical. The average diameter is about six inches. The long axis may lie in any direction, but the concretions as a whole appear to be very roughly grouped as a band parallel to the bedding-plane.

These upper layers appear to be unfossiliferous except for a few echinoid plates or spines. No rolled shell-band nor any worm-tubes were found in this part of the series.

What the writer considers to be perhaps the most important section found occurs in the second small creek East of the Forks. It shows clearly the junction of the upper limestone with the succeeding beds. It is described under the Hutchinsonian Stage.

From this section past the Forks to a little beyond the Downs we again have the escarpment of limestone. This section shows marked variation in its lithological character, and exhibits current-bedding very clearly. Between the Forks and the Downs the beds are more glauconitic and entirely unfossiliferous. No trace of a phosphate band could be found and it is probable that only the upper limestone is here developed. Hard bands alternate with soft almost greensand layers and the latter show the current-bedding most conspicuously. From the railway-line a well-developed talus slope is formed and this, as elsewhere, hides the lower beds of this series and obscures the junction with the greensands.

Opposite the Forks the harder bands are intercalated with fine-grained cemented sandstones. It is less glauconitic than calcareous. The surface is remarkably smooth, and although it is fluted horizontally it does not show the ragged projections of the limestone proper. These sandstones exhibit current-bedding less markedly than do the greensand layers, and further they appear in lenses rather than in bands. Honey-comb weathering occurs here but on a grander scale than in the phosphate horizon. Speight and Wild (p. 186, 1919) note a curious occurrence in these beds. "The greensands are here full of the remains of worm-borings and what look like the casts of fish-intestines, some of them 2 feet in length, 1½ inches thick, elliptical or flattened in cross section, with peculiar transverse curvilinear marking, which is not spiral however. They show a marked reaction for phosphate, and also when broken exhibit the peculiar and characteristic surface appearance of phosphatized limestone, are slightly pinkish in colour, but are composed essentially of calcareous greensand."

South-west of the Downs the escarpment continues for some 800 yards. Further on it becomes vague and limestone is found exposed only on the cap of some small hillocks. On the highest part of the hill on the road from the Downs to Elephant Hill, the country is of the nature of rolling downs, and the boundaries are difficult to trace.

In the outlier or the north bank of the river the limestone outcrop is divided into two by a decided break in feature. A low saddle, which may have been stream-cut, separates the Arno terrace from the river bed. The limestone east of this, where it is found *in situ*, appears to represent the upper beds only. It is fossili-

ferous containing brachiopods, a few foraminifera, the two molluscs already noted and many specimens of echinoderms. These last are certainly divisible into two genera, but they are not here classified. No trace of the phosphate band was found.

The remaining exposure is that of the Fault limestone. This shows the three-fold division, elsewhere noted. The phosphate band is well developed just above the top of the talus slope. It is composed chiefly of large fragments of echinoderms and brachiopods, and some specimens of a cirriped, probably *Balanus*, were found in it.

Considered as a whole the limestone is clearly a shallow-water deposit. Criteria for this conclusion are: the marked current bedding and wave-scourings; the richness in glauconite and the impure state of the deposits. This conclusion has already been reached by several geologists, notably Speight and Wild (1919) and also Marshall (1920).

Speight and Wild (1919) give four analyses of the Waihao limestone which are here reproduced.

	Sand and insoluble	$CaCo_3$	P_2O_5
No. 1	19.98	70.98	1.57
No. 2	26.12	57.77	3.14
No. 3	40.44	52.68	0.86
No. 4	18.42	72.60	1.34

No. 1. Upper hard band of limestone in gully south of Waihao River, near Waihao Forks.
No. 2. Lower band of limestone, same locality.
No. 3. Composite sample, outcrop parallel to railway, Waihao Downs.
No. 4. Calcareous greensand, along the railway between Waihao Forks and Waihao Downs; sample 8-10 ft. above the greensand; rock filled with casts.

Morgan (1919) gives some further analyses from the district as follows:—

	(1)	(2)	(3)	(4)	(5)	(6)
Matter insoluble in acid	25.42	6.01	—	—	—	16.3
Alumina and iron oxides	1.82	1.64	—	—	—	
Calcium carbonate	69.69	89.04	90.25	64.58	29.10	81.0
Magnesium carbonate	2.43	2.98	—	—	—	0.8
Water	0.64	0.33	—	—	—	1.0
	100.00	100.00	—	—	—	99.1
Specific gravity, calculated from weight of 6 inch cube						1.65

References:

(1) Limestone with siliceous bands from Waihao Downs, forwarded by Mr. T. L. Douglas, *Col. Lab. 28th Ann. Rep.*, 1894, p. 11.
(2) Limestone free from siliceous bands. Same contributor and references as No. 1.
(3) (4) From Waihao Downs. Aston, B. C., *Jour. Agric.*, vol. 11, No. 4, Oct. 1915, p. 331.
(5) From McCullough's Bridge, Waihao River. Same reference as Nos. (3) and (4).
(6) Fine grained limestone from Waihao Downs, exhibited by J. Douglas. Black, J. G., in *Official Record of the N.Z. and South Seas Exhibition*, Dunedin, 1889-90, (Wellington, 1891), pp. 369, 371.

Fauna:—The fauna of these beds consists of brachiopods, echinoderms, foraminifera, mollusca, shark's teeth, and a cirriped. Of these only the brachiopods and mollusca have been identified.

The molluscs are:—*Dentalium* sp.
Cirsostrema lyrata (Zittel)
Pecten huttoni (Park)

These forms give practically no help in the matter of correlation. That an extensive molluscan fauna must have existed in the Oligocene sea while the limestone was being deposited is shown by the richness of the distinct molluscan faunas found above and below the limestone. Unsuitable station is the reason advanced for its absence from this horizon.

Brachiopods:—These were sent to Dr. J. A. Thomson, Director of the Dominion Museum, for identification. My best thanks are due to him for his kindness.

Species.	(1)	(2)	*Range elsewhere and Remarks*
Thomsonica gaulteri (Morris).	×	×	Waiarekan to Awamoan; and a closely related form below the Amuri limestone.
Liothyrella landonensis Thomson.	×	×	Ototaran. (Landon Creek, Papakaio, etc., Duntroon greensands, i.e., Park's *L. boehmi* fauna).
Rhizothyris sp. A.	×	×	A dwarf form between *R. lateralis* Th. and *R. pirum* Th. in shape. Probably could be matched in the Duntroon greensands.
Rhizothyris sp. B.	×		A dwarf form comparable to *R. media* Th.; also in Duntroon greensands.
Stethothyris tapirina (Hutton).		×	Ototaran. (including Duntroon greensand and greensand at base of Ngapara limestone.)
Pachymagas ellipticus (Thomson).	×	×	Ototaran. This is rather a series of species than a single species. The Waihao specimens show much the same range of variation as those from the Ototaran of Landon Creek and Papakaio and the Duntroon Greensands.
Pachymagas cf. *clarkei* Thomson	×		With a smaller foramen. *P. clarkei* is lowest Mt. Brown limestone, correlated with Ototaran.
Pachymagas n. sp. A.	×		
Pachymagas n. sp. B.	×		
Pachymagas n. sp. C.	×		

Column (1) Upper Limestone, i.e., above phosphate band.
Column (2) Lower calcareous greensands.

Dr. Thomson remarks (*in litteris*) "Your collections from the limestone are all Ototaran species found in the upper part of the limestone at Landon Creek and in the greensands at the immediate base of the Duntroon and Ngapara limestones, i.e., Park's *L boehmi* fauna; but there are some of the less common species of that fauna not in your collections from Waihao, viz., *Tegulorhynchia* sp. cf. *squamosa, Murravia catinuliformis, Liothyrella boehmi,* and *Campages* n. sp. Of your collection the association *L. landonensis, S. tapirina and P. ellipticus* definitely places the limestone in the Ototaran. Moreover, the upper limestone as well as your lower limestone is Ototaran and this proves that the phosphatic horizon is not that of the Hutchinson Quarry horizon."

Chapman, 1918, cites one species of fish from the Waihao Forks. It is apparently not known from which horizon this tooth came, but it was probably from the limestone or from the greensands. The writer has found shark's teeth from the lower greensands and from the Hutchinsonian beds but they have not been determined. The species recorded by Chapman is *Carcharodon auriculatus* Blainville sp. This form ranges in New Zealand from Upper Cretaceous (Danian) to Tertiary (Eocene to Miocene).

Chapman comments "This species appears to have had an earlier origin in New Zealand than in any other part of the world." (1918, p. 18.)

Correlation:—Gudex (1918) and Speight and Wild (1919) corre late this limestone with that of the Pareora district. McKay (1882), Park (1905), and Marshall (1920) have correlated it with limestones developed in the Waitaki Valley. Neither of these correlations has been proved to date. Dr. Thomson's brachiopod determinations, however, would tend to correlate the beds with the following horizons:—

(1) The upper part of the limestone at Landon Creek;
(2) The Duntroon greensands; and
(3) The greensands at the base of the Ngapara limestone.

HUTCHINSONIAN STAGE.

Hutchinsonian beds are here recorded from Waihao for the first time. All geologists who have written on the area, except McKay, have considered that the limestone was conformably overlain by the Mt. Harris Awamoan beds. The Hutchinsonian stage is restricted in occurrence, and nowhere forms a surface outcrop. The section is exposed on the west side of the second small creek which enters the Waihao from the south, three-quarters of a mile east of the Forks. About 200 yards upstream a huge block has become detached from the cliff, but still stands upright and exhibits a similar sequence to that found in the main cliff.

The lowest member of the section is the normal upper fluted limestone which is here very dark in colour and richly glauconitic, being almost a cemented greensand. It is again exposed on the east side of the creek and there forms the top bed. The limestone dips south at an angle of 5° and shows the usual alternative bands of hard and soft material, the latter showing numerous worm-borings.

The limestone is succeeded by a wedge of dark greensand which is 20 feet thick at the extreme north of the section, and gradually thins down to a few inches at the south end. This bed shows marked current-bedding and consists of very fine, dark-black, friable greensands which exhibit up to 25 laminations per inch.

At the base of this bed, i.e., in contact with the limestone, a shelly surface is shown; another is found at the upper surface immediately beneath the succeeding beds. No identifiable brachiopods were collected, but fragments occur. When observed under the microscope, after treatment with hydrochloric acid, the sediment is seen to be composed of rounded grains of dark-green glauconite, a small amount of quartz grains and, rarely, flakes of mica. No feldspar was found. In addition the glauconite frequently takes the form of moulds of foraminifera, particularly of forms which agree in outline with *Textularia* and *Cristellaria.* Minute fish-teeth are also present.

When traced further upstream this band is thinned down to a layer of shell-fragments, from a few inches to 2 feet in thickness. It contains a varied assemblage of forms, among which are corals, sharks' teeth, fragments of brachiopods and echinoderms, portions of the stems of a crinoid, a cirriped like *Balanus,* and a *Pecten* allied to the *P. burnetti* group. Nodules of a black, resinous substance are common.

The next bed in the sequence is marked off from the lower one last described by a clear cut line marking a decided change (and probably pause) in sedimentation. The upper bed is sandy-clay, approximately 40 feet in thickness, is roughly banded, and is pale blue-grey in colour. Most of the section, however, appears yellow, but this is due to a film of clay descending from the brown clays above. From this bed typical Hutchinsonian brachiopods were collected. It also contains echinoderms. It dips south, but at an angle of 10°. Hence there is a slight angular unconformity between these clays and the limestone. This point is not stressed and can probably be explained by the introduction of the wedge of greensand.

These clays grade imperceptibly up into typical yellow-brown sands and clays of the Mt. Harris beds, which are here, as in almost all other exposures of the lower parts of the Awamoan beds, in the district, devoid of fossils.

The brachiopods have been determined by Dr. J. A. Thomson.

Species.	*Range elsewhere and remarks.*
Liothyrella n. sp.	Not *L. landonensis* nor *L. neglecta,* (Hutton).
Pachymagas cf. marshalli (Andrew). *P.* cf. *hectori* Thomson *P.* cf. *haasti* Thomson	*Pachymagus parki* series—can be matched in the Hutchinsonian greensands of Kakanui and other Oamaru localities.
?*Pachymagas* n. sp. A.	Waihao Limestone—Ototaran.
?*Pachymagas* n. sp. B.	Waihao Limestone—Ototaran.

Of the forms Dr. Thomson says *(in litteris)* that the beds above the Upper Limestone contain no Ototaran species; the forms being all

referable to species found in the Hutchinson Quarry beds of Kakanui and other Oamaru localities; though the special species of Hutchinson Quarry itself, viz., *P. parki* and *R. rhizoida*, etc., are absent as they are in most of the Hutchinson Quarry greensands round Oamaru. The beds here considered correlate with the Kakanui greensands.

Correlations—These beds as Dr. Thomson states above are correlated with the Kakanui greensands, i.e., the Lower Hutchinsonian of Park (1918)or the true Hutchinsonian as recognised by Thomson and Uttley. No two-fold division, in the usage employed by Professor Park, is present at Waihao. In other words if the Upper Hutchinsonian of Park (1918) is present, it is basal Awamoan, as Dr. Uttley, 1920, contends for the Oamaru district, and has no lithological or palaeontological features which would serve to make it a useful substage.

AWAMOAN STAGE.

The Awamoan beds are found over a wide area in the district between the Waihao and the Waitaki Rivers. They have not been examined by the writer as fully as the lower beds. The reason is twofold; first, these beds, in the area mapped, are covered for the most part by low grassy downs and outcrops are relatively few; second, the Awamoan stage is perhaps that most fully described in the Notocene of New Zealand, and hence more attention has been given to the lower, less-known stages. The fossils collected by the writer from this stage were in beds just outside the area mapped, viz., the summit of Mt. Harris, where fine exposures are found. However, the fossils are not well preserved, and are sporadic in occurrence, being for the most part confined to narow bands.

Von Haast describes this series as consisting "mostly of bluish or greenish argillaceous sands, with harder, calcareous, mostly fossiliferous beds interstratified with them." (1879, p. 317.)

McKay gives this description: "In their lower beds they consist of sands and sandy clays, passing upwards into marly clays of a light-grey colour. At many places in the middle part of the beds, fine-grained blue concretions are abundant, crowded with fossil shells, generally in the conditions of casts." (1882, p. 64.)

Whenever a section was found in the area mapped the beds had a low southerly dip. Where the Waihao leaves its gorge and enters the alluvial plains, is an interesting section of the Notocene beds which is described elsewhere in this paper. Here the Mt. Harris beds appear to underlie the greensands, but are apparently faulted against them. The fault strikes across the river, but cannot be traced for any distance away from the section exposed on the bank of the river. The beds here are fossiliferous and contain fine-grained blue-grey concretions crowded with fossils. These are, however, difficult to collect.

In the following list of Mollusca several alterations (consequent on revision of the fossils) have been made in the names assigned to forms previously stated to occur here, and a number of new records have been added. The identifications have been checked by Mr. H. J. Finlay.

Baryspira robusta (Marwick).
Bathytoma haasti (Hutton).
Cirsostrema lyrata (Zittel).
Cochlis notocenica (Finlay).
Comitas oamarutica (Suter).
Corbula humerosa Hutton.
Cucullaea worthingtoni Hutton.
Dentalium mantelli Zittel
**Dentalium nanum* Hutton.
Dentalium solidum Hutton.
Inquisitor awamoaensis (Hutton).
Linemera pukeuriensis (Finlay).
Lissotesta n. sp.
Maoricolpus cavershamensis (Harris).
Maorivetia brevirostris (Hutton).
Marginella fraudulenta Suter.
Mesalia striolata (Hutton).
Monia incisura (Hutton).
Nassarius socialis (Hutton).
Nassicola costata (Hutton).
Neilo awamoana Finlay.
Pecten huttoni (Park).
**Sigapatella novaezelandiae* Lesson.
Spinomelon parki (Suter).
Spissatella trailli (Hutton).
Stiracolpus n. sp.
Syrnola semiconcava Marshall & Murdoch.
†*Therasia thaisa* Hutton.
Typhis maccoyi Ten.-Woods.
Venericardia awamoaensis Harris.
Venericardia zelandica (Deshayes).
Venustas fragilis (Finlay).
Verconella n. sp.
Xymenella lepida (Suter).
**Zeacrypta monoxyla* (Lesson).
**Zenatia acinaces* Q. & G.

The following species originally described from this locality may be added:—

Coluzea dentata (Hutton) (as *Fusus*).
Cominula (*Procominula*) *exsculpta* (Suter) (as *Cominella*).
Phenatoma (*Cryptomella*) *transenna* (Suter) (as *Lencosyrinx*).

In his revision of the Naticidae and Struthiolariidae Dr. Marwick notes the following additional forms: —

Natica harrisensis Marwick.
Uber lobatus Marwick
Globisinum miocaenicum (Suter).
Struthiolaria subspinosa Marwick.
S. spinifera Marwick.

Forty-four species are here recorded of which four are Recent species, a percentage of 9. This list does not give a complete account of the fauna of the Mt. Harris beds, which were incompletely collected. However, the lists in *N.Z. Geol. Surv. Pal. Bull.* No. 8, pp. 64-67, contain so many errors that it is considered inadvisable to take them into consideration.

An analysis of this list shows clearly that the fauna as a whole is closely related to that found in other Awamoan beds in the type district. The percentage of Recent species (and it is probably excessive) is lower than those given for the type Awamoan beds in *Pal.* Bul. No. 8, 1921, but this result was not unexpected. As the nomenclature is revised and "group-series" are subdivided reductions in the percentage of Recent forms as given by Suter are inevitable. The

*Recent forms.
†This land-shell was determined by the late Mr. R. Murdoch to whom my thanks are due.

figures given by Suter are: for Pukeuri, 29%; for Awamoa, 38%; and for Target Gully, 33%.

Only two species on this list occur also in the Waihao greensands —these are *Pecten huttoni* Park and *Nassicola costata* (Hutton). Both of these identifications from the greensands may be considered doubtful, hence the faunas are practically distinct. This fact leads the writer to suppose either that disconformities not at present apparent must occur, or that the deposition of the intermediate beds—the Hutchinsonian clays and the Ototaran limestones—which have no molluscan fauna, must have taken an immense period of time—a conclusion which is apparently at variance with the obvious shallow-water origin of these beds but one which Dr. Marshall has arrived at from faunal studies. "The time that elapsed was sufficiently long to allow of a large number of species, and even genera, becoming extinct, and of the development (or at least of the migration) of a large number of other species." (1923, p. 119.)

The presence of two fossil land-shells, *Thalassohelix igniflua* (Reeve) found by Dr. Uttley, and *Therasia thaisa* Hutton, found by the writer, is of interest. The specimens found by the writer were distinctly embedded in the sandy matrix in a cliff face. However it is possible that they are of more Recent age and have become embedded during floods or old slips. Recent members of both these species are found in the Canterbury district, and are restricted to the South Island (Suter, 1913, pp. 628-9 and 660-661).

Correlation:—The Mt. Harris beds, then, are to be correlated with other typical Awamoan horizons near Oamaru, particularly with those beds at Awamoa, and Pukeuri. They are also correlated by Gudex, 1918, with the Pareora blue-clays and red sands above the limestone in the Pareora district.

NOTOPLEISTOCENE.

(*a*) Recent River Gravels, talus and silts.
(*b*) Loess.
(*c*) Older gravels.

(*a*) The Recent gravels cannot be distinguished except in position, from the older gravel terraces, in fact they are probably formed in part by the re-sorting of the older terraines by fluvial action. They consist of greywacke boulders of various sizes in a matrix of sands and clays derived from the Notocene sediments.

At one exposure below the ford over the Waihao they are of interest in that they contain derived fossils from the Mt. Harris beds, together with many fossil land-shells. The latter have probably been carried down by the stream and have become embedded in the silts. The derived fossils collected were:—

Dentalium solidum Hutt.
Comitas oamarutica (Suter).
Spissatella trailli (Hutt.).
Limopsis zealandica Hutt.

The land-shells have been identified through the kindness of the late Mr. R. Murdoch, of Wanganui. They are:—

Allodiscus planulatus Hutt.
Allodiscus ? sp.
Charopa coma Gray var.
Charopa longstaffae Suter (?).
Thalassohelix igniflua Reeve.

These forms do not throw any light on the Pleistocene range of the species in question. As Recent forms, *A. planulatus* and *C. coma* are found fairly plentifully over both Islands and the latter species has been noted from the Pleistocene beds at Petane, near Napier, *T. igniflua* is found only in the south half of the South Island. *C. longstaffae* is in the Suter collection, Wanganui Museum, but is not cited in Suter's Manual, 1913.

(*b*). *Loess deposits*:—These beds occur at two places in the district and both occurrences appear to be the remnants of much wider outcrops. The larger covers the older gravels where the Waihao River leaves its lower gorge and this deposit is probably part of the greater extent of loess which spreads over the Canterbury Plains from Timaru southwards. The second outcrop is found in a road-cutting near the Waihao Downs Farm Station.

Wild, 1919, gives a compact summary of the various opinions which have been expressed as to the origin of this formation.

"Haast (1879) was of the opinion that the deposit is similar in origin to the loess of China described by Baron von Richthofen—that is to say, it is an aeolian deposit. In this opinion he has been supported by Hardcastle (1890), by Speight (1908 and 1917), and by Professor A. Heim (quoted by Speight, 1908), of the University of Zurich. Marshall (1912) has also declared his adhesion to Haast's view. Hutton (1905) always strenuously opposed this theory, maintaining the deposit to be a marine silt laid down during a period of submergence of the plains; and he quotes Professor Boehm, of Freiberg, in support of his arguments." (1919, p. 286.)

Wild's contribution to the problem lends some support to Hutton's hypothesis, since he shows that whereas according to Udden* the average largest size of quartz-particles sustained in air by strong winds is 0.1 m.m. in diameter, the composition of the loess shows that from 28 to 40 per cent. of the particles have a diameter ranging from 0.04 m.m. to 0.2 m.m., while there is also a certain small quantity of material over 0.2 m.m. in diameter.

Hence Wild concludes "we have here, therefore, a very strong argument against the aeolian hypothesis." (1919, page 287.)

Wild further stresses the absence of organic matter in this deposit. Richthofen had postulated vegetation to fix the wind-blown waste as it settled.

However if, as Hutton and Wild suppose, this loess is a marine silt, surely some evidence of organic origin other than *Dinornis* and other land birds would be preserved. If submergence did occur the

*J. A. Udden, *Journ. Geol.*, vol. 2, page 323, 1894.

sunken area must have formed the littoral zone where molluscan and other marine life usually abounds.

(*c*) *Older Gravels*:—These beds were placed by McKay (1882) as the upper part of the Pareora System. However, they do not appear to be an integral part of the " Miocene " beds, and are here treated as the lowest member of the Notopleistocene. These gravels overlie the Notocene beds with marked unconformity, except where it so happens that they cover an eroded surface parallel to the strike of the beds. Then a disconformity is present.

They are extensively developed in the area, chiefly as terraces which run back from the river-bed. Most of the gravel-capped terraces may be referred to one or other of four major terrace formations which are discussed in more detail in the topographical section.

They consist of boulders, up to 2 feet or more in diameter, of greywacke with a rubbly matrix of limestone, greensands, quartz pebbles, etc., the whole being loosely put together. For the most part they appear to be younger than the block-faulting movements. In the faulted section these gravels overlie both formations along the fault-contact and do not enter into the vertical movement. However, in a section given by McKay (1882) near Elephant Hill the gravels appear to have taken part in the faulting.

This paper gives a complete account of the molluscan fauna of the various beds at Waihao, with the exception of a few species still to be described from the Waimateian stage. Most of these are badly preserved, and suitable illustrations could not be obtained for the present paper. They have all been included as n. sp. or "Allan MS" in the lists given in this paper.

BIBLIOGRAPHY.

1877.

HUTTON, F. W. Descriptions of some new Tertiary Mollusca from Canterbury. *Trans. N.Z. Inst.*, vol. 9, p. 597, 1876.

MCKAY, A. On the Young Secondary and Tertiary Formations of Eastern Otago, Moeraki to Waikouaiti. *Rep. Geol. Explor.*, 1887, pp. 1-21.

MCKAY, A. On the Geology of the Coast-line, Moeraki Peninsula to Kakanui and North-east Otago. *Ibid*, pp. 223-239.

MCKAY, A. Oamaru and Waitaki Districts. *Rep. Geol. Explor.*, vol. 10 (1876-77) pp. 41-66.

1879.

HAAST, J. VON. *Geology of the Provinces of Canterbury and Westland*, pp. 310-315. 1879.

1882.

MCKAY, A. Geology of the Waitaki Valley and Parts of Vincent and Lake Counties. *Rep. Geol. Explor.* 1881, pp. 56-92.

1885.

TATE, R. The Lamellibranchs of the Older Tertiary of Australia (Part 1). *Trans. Roy, Soc. S. Austral.*, 1885. (Reprint, p. 23. *Pecten zitteli* Hutt., Waihao River.)

1886.

LINDOP, A. B. On the Waihao Coalfield. Rep. Geol. Explor., vol. 17 (1885), pp. 21-22.

PARK, JAMES. On the Kakahu District, Canterbury. *Rep. Geol. Explor.*, 1885, pp. 170-178. 1886.

1887.

HUTTON, F. W. Note on the Geology of the Valley of the Waihao in South Canterbury. *Trans. N.Z. Inst.*, vol. 19, pp. 430-3.

1887.

McKay, A. The Waihao greensands, and their Relation to the Ototara Limestone. *Ibid.*, pp. 434-440.

McKay, A. On the Identity and Geological Position of the Greensands of the Waihao Forks, Waihao Valley, South Canterbury. *Rep. Geol. Explor.*, vol. 18, (1886-7), pp. 91- 119.

1888.

Hutton, F. W. On the Greensands of the Waihao Forks. *Trans. N.Z. Inst.*, vol. 20, pp. 264-7.

1890.

Hardcastle, J. Origin of the Loess Deposit of the Timaru Plateau *Trans. N.Z. Inst.*, vol. 22, pp. 406-414, 1890.

1891.

Hardcastle, J. On the Drift in South Canterbury. *Trans. N.Z. Inst.*, vol. 23, pp. 311-324, 1891.

1892.

McKay, A. Marlborough and S. E. Nelson. *Rep. Geol. Explor.* during 1890-91, pp. 1-28.

1905.

Hutton, F. W. The Formation of the Canterbury Plains. *Trans. N.Z. Inst.*, vol. 37, pp. 465-472, 1905.

Park, James. On the Marine Tertiaries of Otago and Canterbury, with Special Reference to the Relations existing between the Pareora and Oamaru Series. *Trans. N.Z Inst.*, vol. 37, pp. 489-551. (Especially pp. 527-530) 1905.

1906.

Suess, E. (1888) (1906) *Das Antlitz der Erde*, Sollas's translation, vol. 2, p. 148.

1908.

Speight, R. Some Aspects of the Terrace-development in the Valleys of the Canterbury Rivers. *Trans. N.Z. Inst.*, vol. 40, pp. 16-43, 1908.

1910.

Park, James. *The Geology of New Zealand.*

1912.

Marshall, P. New Zealand and Adjacent Islands (in Steinmann's *Handbuch der regionalen Geologie.*)

1913.

Cotton, C. A. The Physiography of the Middle Clarence Valley, New Zealand. *Geogr. Journ.*, vol. 42, pp. 225-46.

Suter, H. Manual of the New Zealand Mollusca.

1914.

Suter, H. *N.Z. Geol. Surv. Pal. Bull* No. 2.

Thomson, J. A. Coal Prospects of the Waimate District, South Canterbury. *8th Ann. Rep. N.Z. Geol. Surv.*, Mines Statement, 1914, pp. 158-62.

1915.

Iredale, T. A commentary on Suter's "Manual of the N.Z. Mollusca." *Trans. N.Z. Inst.*, vol. 47, 1914.

Marshall, P. Cainozoic Fossils from Oamaru. *Trans. N.Z. Inst.*, vol. 47, pp. 377- 387, 1915.

Speight, R. The Intermontane Basins of Canterbury. *Trans. N.Z. Inst.*, vol. 47, pp. 336-353.

Suter, H. *N.Z. Geol. Surv. Bull.* No. 3.

Thomson, J. A. Classification and Correlation of the Tertiary Rocks, *8th Ann. Rep. N.Z. Geol. Surv.*, pp. 123-24.

1916.

Cotton, C. A. The Structure and Later Geological History of New Zealand. *Geol. Mag.*, Dec. 6, vol. 3, pp. 243-49; 314-20.

Thomson, J. A. On Stage Names Applicable to the Divisions of the Tertiary in New Zealand, *Trans. N.Z Inst.*, vol. 48, pp. 28-40, 1916.

1917.

Suter, H. *N.Z. Geol. Surv. Pal. Bull.* No. 5.

Thomson, J. A. Diastrophic and other Considerations in Classification and Correlation, and the Existence of Minor Diastrophic Districts in the Notocene. *Trans. N.Z. Inst.*, vol. 49, pp. 397-403, 1917.

1918.

CHAPMAN,, F. *N.Z. Geol. Surv. Pal. Bull.* No. 7, 1918.

COTTON, C. A. River Terraces in New Zealand. *N.Z. Journ. Sci. Tech.*, vol. 1, pp. 145-52.

GUDEX, M. C. The Succession of Tertiary Beds in the Pareora District, South Canterbury. *Trans. N.Z Inst.*, vol. 50, pp. 244-62, 1918.

MARSHALL, P. The Tertiary Molluscan Fauna of Pakaurangi Point, Kaipara Harbour. *Trans. N.Z Inst.*, vol. 50, pp. 263-278.

PARK, JAMES. The Geology of the Oamaru District, North Otago. *N.Z. Geol. Surv. Bull.* No. 20 (New Series) 1918.

1919.

MORGAN, P. G. The Limestone and Phosphate Resources of New Zealand. *N.Z. Geol. Surv. Bull.* No. 22 (New Series) 1919.

WILD, L. J. and SPEIGHT, R. The Limestones of Canterbury considered as a possible Source of Phosphate. *N.Z. Journ. Sci. Tech.*, vol. 2, No. 3, pp. 180-192, 1919.

WILD, L. J. Note on the Mechanical Composition of the So-called Loess at Timaru. *Trans. N.Z. Inst.*, vol. 11, pp. 286-288.

1920.

MARSHALL, P. The Hampden Beds and the New Zealand Limestones. *Trans. N.Z. Inst.*, vol. 52, pp. 111-114, 1920.

THOMSON, J. A. The Notocene Geology of the Middle Waipara and Weka Pass District, North Canterbury, New Zealand. *Trans. N.Z. Inst.*, vol. 52, pp. 322-415, 1920.

UTTLEY, G. H. Remarks on Bulletin No. 20 (New Series) of the N.Z. Geol. Surv. *Trans. N.Z. Inst.*, vol. 52, pp. 169-182, 1920.

UTTLEY, G. H. Tertiary Geology of the Area between Wharekuri and the Otiake River, North Otago. *Trans. N.Z Inst.*, vol. 52, pp. 154-165, 1920.

1921.

BENSON, W. N. Recent Advances in New Zealand Geology, Presidential Address, Hobart-Melbourne Meeting of Aust. Ass. Adv. Sci., 1921. *Rep. Aust. Assoc. Adv. Sci.*, vol. 15, pp. 45-133.

SUTER, H. *N.Z. Geol. Surv. Pal. Bull.* No. 8, 1921.

1922.

COTTON, C. A. Geomorphology of New Zealand (Part 1) 1922.

MORGAN, P. G. Notes on the Geology of New Zealand. *N.Z. Journ. Sci. Tech.*, vol. 5, No. 1, pp. 46-57.

1923.

MARSHALL, P. Early Tertiary Molluscan faunas of New Zealand. *Trans. N.Z. Inst.*, vol. 54 pp. 115-121, 1923.

MARSHALL, P. and MURDOCH, R. Some Tertiary Mollusca, with Descriptions of New Species. *Ib.*, pp. 121-8.

PARK, J. On the Discovery of the *Liothyrella boehmi* Greensand Band at Flume Creek, Waitaki Valley. *Ib.*, pp. 80-82.

PARK, J. On the Relation of the Oamaru Limestone and Waitaki Stone. *Ib.*, pp. 82-87.

1924.

FINLAY, H. J. Some necessary changes in Names of New Zealand Mollusca. *Proc. Malac. Soc.*, vol. 16, pt. 2, June, 1924, p. 99.

FINLAY, H. J. New Shells from N.Z. Tertiary beds. *Trans. N.Z Inst.*, vol. 55, pp. 450-479, 1924.

FINLAY, H. J. The Molluscan Fauna of Target Gully. *Ib.*, pp. 495-516.

MARWICK, J. The Struthiolariidae. *Ib.*, pp. 161-190.

MARWICK, J. The Tertiary and Recent Naticidae and Naricidae of New Zealand. *Ib.*, pp. 545-579.

WILCKENS, O. Lahillia and some other Fossils from the Upper Senonian of New Zealand. *Ib.*, pp. 539-544.

1925.

ALLAN, R. S. The Geology of the lower Waihao Basin, South Canterbury, New Zealand. *Aust. Assoc. Ad. Sc.* Adelaide, 1926, pp. 323-26.

——— Fossil Mollusca from the Waihao Greensands, *Trans. N.Z Inst.*, vol. 56, 1926, pp. 338-46.

New Trilobites from the Ordovician Beds of New Zealand.

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[*Read before the Wellington Philosophical Society, 9th September, 1925; received by Editor, 21st October, 1925; published separately, 10th December, 1926.*]

Ogygites collingwoodensis n.sp. (Fig. 1.)

HEAD-SHIELD transversely semicircular, flattened. Glabella very slightly elevated, semicylindrical, about one-third (or less) the width of the head-shield and three-fourths its length, strongly rounded at front end; frontal lobe somewhat inflated, pyriform, with stalk nearly reaching back to occipital furrow, bounded behind by weak, oblique, long lateral furrows marking off large depressed subtriangular basal lobes. Meso-occipital ring flattened, bearing median tubercle; occipital furrow weak. Cheeks and pre-glabella-area flattened; eyes large, semilunar with slightly swollen eye-lobes, situated at about one-third the length and at two-thirds the width of the glabella from its sides. Pleuro-occipital ring narrow, marked off by straight distinct furrow. Genal angles and facial sutures not preserved, but anterior transverse union of facial sutures in front of pre-glabellar area forming a continuous curve.

Thorax composed of eight segments, flattened, horizontally extended; axis broad, gently convex, semicylindrical, slightly decreasing in width posteriorly; axial rings simple, flattened. Pleurae horizontally extended and straight as far out as fulcrum, then slightly bent back, recurved and pointed; pleural furrow strong, non-median, slightly diagonal, situated nearer the anterior edge, increasing in width to fulcrum, then rapidly thinning out; anterior part of pleura much narrower and less swollen than posterior part; fulcrum obtusely angular, situated at about two-thirds length of pleurae.

Pygidium, large, semi-elliptical, nearly twice as wide as long, very gently convex, with marginal third somewhat depressed and concave. Axis conical, gently convex, about four-fifths the length of the pygidium, tapering more rapidly in anterior part than behind, ending in small blunt slightly elevated tip some distance inside margin; composed of 8-9 distinct rings in anterior two-thirds and of a faintly annulated posterior third; lateral lobes with inner portion gently convex and marked with eight flattened simple unfurrowed pleurae separated by strong interpleural furrows, corresponding with axial rings and slightly angulated at about two-thirds their length, successively decreasing in size and all ending at about two-thirds the width

of the lateral lobes so as to leave a wide, smooth, gently concave undefined marginal area all round the pygidium.

Dimensions.

	A.	B.
Length of whole trilobite	c. 60.0mm.	
Width of head-shield	c. 41.0mm.	
Length of head-shield	c. 22.0mm.	
Length of glabella	c. 15.0mm.	
Length of thorax	20.0mm.	
Width of axis of thorax at front	12.0mm.	
Width of pygidium	c. 41.0mm.	c. 40.0mm.
Width of axis of pygidium	9.5mm.	8.5mm.
Length of pygidium	——	22.0mm.
Length of axis of pygidium	——	18.0mm.

Locality: Paturau River, Collingwood district, Nelson, N.Z.

Remarks: There are two specimens of this trilobite, both from a boulder in the Paturau near Thompson Creek*; one is a complete individual, but the free cheeks, the anterior margin of the head-shield and the posterior end of the pygidium are broken, and the tips of the thoracic pleurae are obscured; the other is a nearly complete but slightly distorted pygidium, with part of its right edge hidden by matrix. The reference of this species to one of the Asaphidae in its broad sense is obvious, and it seems almost indistinguishable from *A. ("Basilicus") kuckersianus Schmidt*[1] from the Kuckerschiefer of the Baltic provinces; the pleural furrow on the thoracic segments sems to be less diagonal and the fulcrum situated further out in this New Zealand form: the eyes also appear to be less closely placed to the glabella, but the head-shield is too imperfectly known for an exact comparison. The other allied Baltic species, "*B*" *kegelensis* Schmidt[2], and *B. lawrowi* Schmidt[3], seem less closely related to it. All come from the lower part of the Ordovician. Raymond[4] has pointed out that the *Basilicus* of Schmidt is not the *Basilicus* of Salter, and that these three Russian species belong to the genus *Ogygites (= Ogygia* Brongniart). *Ogygites* has a forked hypostome like *Basilicus,* but *Ogyginus,* to which "*Ogygia*" *corndensis* Salter, belongs, has an entire hypostome, otherwise the two are considered by him to be almost exactly alike. We do not know the hypostomal characters of the New Zealand species, so that a slight doubt must remain as to generic reference if we accept Raymond's nomenclature and classification. At any rate he is undoubtedly correct in his opinion that the Russian species above-mentioned do not belong to Salter's subgenus *Basilicus,* of which *Asaphus tyrannus* Murch. is

**N.Z. Geol. Surv., Bull.* No. 25 (N.S.), *Collingwood Subdiv.* (1923), p. 22.

(1) Schmidt, Rev. Ostbalt. Silur. Trilob. (*Mem. Acad. Imper. Sc. St. Petersb.*, 14, No. 10, 1904) Abt. 5, Lief. 3, p. 25, T. 4, figs. 8–14.

(2) *Ibid.* p. 29, t. 5, figs. 1–3.

(3) *Ibid.* p. 23, t. 4, figs. 1–7.

(4) Raymond, *Trans. Roy. Soc. Canada*, Ser. 3, Vol. 5, Sect. 4, 1911, pp. 111–120, pts. 1–3.

the type. The Lower Ordovician species *Ogygites birmanicus* Reed[1], which the author described from the Hwe Mawng Beds of the Northern Shan States, Burma, may be compared with this New Zealand one, but it is not so closely allied as *O.* [*Basilicus*] *kuckersianus* of Russia. The Yunnan species *O. yunnanensis*[2] which the author subsequently described from the Ordovician beds of Pupiao in that country, and considered as very closely allied to the above-mentioned one from Burma is still more closely related to *O. collingwoodensis*, but the glabella is very imperfectly known, and we may hesitate to regard them as identical. Mansuy[3] has more recently described a trilobite from the Ordovician of Annam as *O. annamensis,* and he compares it with *O. birmanicus*. The pygidium is especially like this new one from New Zealand.

This type of trilobite appears to be characteristic of the Lower Ordovician beds, if not confined to them, and we may therefore regard it as probable that theNew Zealand species is likewise of the same age.

None of the Asaphids described from the Ordovician of Australia are closely related to it.

Dionide hectori n.sp. (Fig. 2.)

Head-shield transversely semicircular, with the genal angles produced back and acutely pointed. Glabella (incompletely known) subquadrate or oblong and truncated in front, about two-thirds the length of the head-shield, more or less convex, with two (?) pairs of short lateral furrows. Cheeks of head-shield gently convex, more or less inflated, united in front of glabella, crossed by short arched cheek-line starting from middle of side of glabella and curving back to join pleuro-occipital furrow some distance out. Surface of cheeks covered with small tubercles and minute pits amongst very delicate reticulating lines; a larger prominent "ocular" tubercle level with front of glabella is situated at about half its width from its side on each cheek. Border of head-shield narrow, rounded, with broader convex concentrically striated doublure. Occipital segment well marked off by furrow from cheeks.

Thorax of 6 (or 7) segments. Axis convex, cylindrical, tapering very strongly behind; axial rings with slight lateral swellings. Pleura straight, horizontal to fulcrum which is situated at about three-fourths their length, then bent back and ending in free points; pleural furrow deep, strong; surface of pleurae crossed by transverse wrinklings. Pygidium large, semi-oval or semi-elliptical, flattened, with long narrow conical axis, annulated for whole length and nearly or quite reaching posterior margin; lateral lobes composed of 5-6 elevated strongly furrowed pleurae, separated by well marked fur-

(1) Reed, Supplem. Mem. Ordov. and Silur. Foss. from Northern Shan States, *Palaeont. Indica*, N.S. Vol. 6, Mem. N. 1, 1915, p. 30, pl. 5, pp. 15–18, pl. 6, figs. 1–4.

(2) Reed, Ordov. and Silur. Foss. from Yunnan, *Palaeont. Indica*, N.S. vol. 6, Mem. No. 3, 1917, p. 42, pl. 6, figs. 12–14, pl. 7, figs. 1–8.

(3) Mansuy, *Mem. Serv. Geol. Indo-Chine*, vol. 7, fasc. 1, 1920, p. 9, pl. 1, figs. 6 a–g.

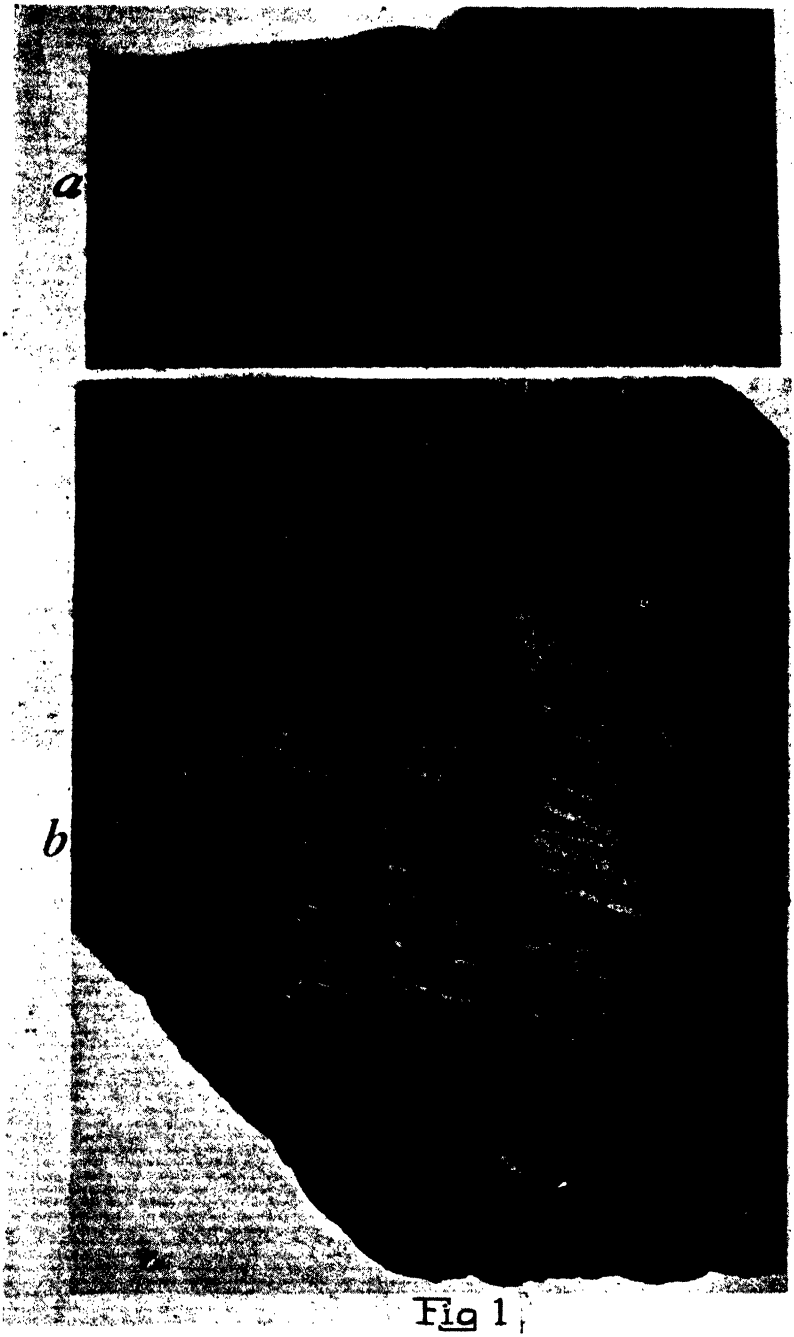

FIG. 1.—*a*. *Ogygites collingwoodensis* n.sp. Pygidium. × 2. Paturau R., Collingwood district, Nelson.
b. ditto. Nearly complete individual. × 2. Same locality.

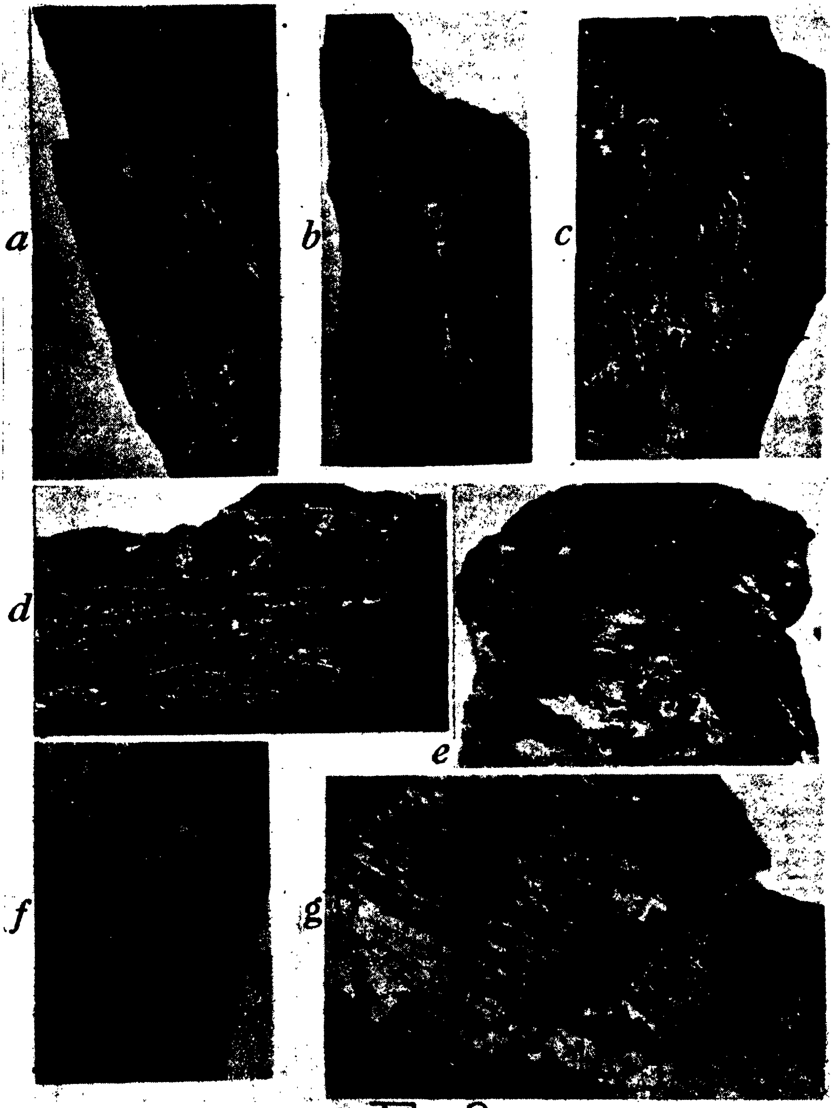

Fig 2

FIG. 2.—*a. Dionide Hectori* n.sp. Nearly complete individual, somewhat distorted. × 2½. Taylor–Wangapeka Watershed, Nelson.

b. ditto ditto. × 2½. Same locality.

c. ditto. Pygidium, obliquely distorted, showing spines. × 4. Same locality.

d. ditto ditto. Transversely distorted. × 2½. Same locality.

e. ditto. Head-shield and part of thorax. × 2½. Same locality.

f. ditto. Portion of thorax, showing ornamentation of pleurae. × 2½. Same locality.

g. ditto. Impression of transversely-distorted nearly com-

rows and reaching narrow rounded border, the last two pairs sub-parallel; the first pair wider than all the rest and produced beyond margin into long slender sub-parallel spines about twice the length of the pygidium, curving gently inwards and ornamented with fine longitudinal granulated lines. General surface of pygidium finely tuberculated.

Dimensions: Approximate length of trilobite 25-30 mm.

Locality: Taylor-Wangapeka Watershed, Nelson, N.Z.

Remarks: There are nine fragmentary specimens of this species all more or less distorted, crushed, and imperfect. In one case (Fig. 2, b) we have the impression of the exterior and the cast of the whole individual, but it is much twisted and laterally compressed. In another (Fig. 2, a) we have a nearly complete specimen, poorly preserved, but it shows the pygidial lateral spine on one side. In another (Fig. 2, e) the glabella, cheeks and ocular tubercle are fairly well shown. In a transversely distorted specimen (Fig. 2, d) and in the obliquely crushed one (Fig. 2, a) the genal angles are more or less preserved. The pygidium and its impression with the spines complete are perfect in another case (Fig. 2, c), but the thorax and head-shield are missing. The ornamentation of the cheeks is well seen in Fig. 2, a, and in most of the specimens the fine tuberculation of the thorax and pygidium is visible. In no case is the thorax well preserved and it is difficult to decide whether there are six or seven segments in it, though the larger number would be exceptional. By collecting the evidence from these various specimens we are able to give a fairly complete account of the characters of this new species, the affinities of which seem to be with *Dionide richardsoni* Reed[1], rather than with *D. lapworthi* Eth. and Nich.[2], *D. atra* Salt.[3], *D. formosa* Barr., or *D. euglypta* Ang. The chief peculiarity and distinctive feature is in the pair of lateral spines on the pygidium which suggests *Lichapyge problematica* Reed[4] from Girvan and recalls some Cambrian genera such as *Stephanocare, Drepanura* and *Teinistion.*

Dionide is typically an Ordovician genus, and the species to which this New Zealand form is most allied comes from the Upper Bala beds of the Girvan district. Raymond[5] compares a North American species *D. holdoni,* which occurs associated with a typical Normanskill fauna, with *D. richardsoni,* but the pygidium as in that species has no lateral spines. The genus has been also described from Eastern Asia; Mansuy[6] figured a form from the Ordovician of Eastern Yunnan which he referred to the Bohemian species *D. formosa* Barr., and

(1) Reed, Lower Palaeozoic Trilobites of Girvan (*Palaeont. Soc.*), pt. 1, 1903, p. 26, pl. 4, figs. 3–8.

(2) *Ibid.* p. 25, pl. 4, figs. 1, 2.

(3) Reed, *Geol. Mag.* Dec. 5, vol. 9, 1912, pp. 200–203, pl. 11, figs. 1–6.

(4) Reed, Lower Palaeozoic Trilobites of Girvan (*Palaeont. Soc.*), pt. 3, 1906, p. 110, pl. 15, figs. 8–10.

(5) Raymond, *Bull. Mus. Compar. Zool.* Harvard, vol. 64, No. 2, 1920, p. 274.

(6) Mansuy, *Mem. Serv. Geol. Indo Chine*, vol. 1, fasc. 2, Étude geol. Yunnan Orientale pt. 11, Paléont., 1912, p. 37, pl. 6, figs. 2a, 2b.

the present author[1] described a new species from the Hwe Mawng Beds of the Northern Shan States as *D. hybrida* which was considered to be allied to the same Euorpean species. But only the head-shield of this Burmese form is known.

The genus *Dionide* is restricted to the Ordovician in Europe, Asia and America, so that on the strength of this evidence these New Zealand beds may be referred to the same period without hesitation.

Since the preceding notes were written a further paper on Ordovician trilobites has appeared by Raymond[2] in which he describes the four Bohemian species of *Dionide* and the two from Virginia. The likeness of *D. holdoni* Raymond, to *D. richardsoni* Reed is again observed, but the other American species, *D. contrita* Raymond, has much more numerous segments in the pygidium.

Occurrence of Pilchards and Sprats in New Zealand Seas.

By Maxwell Young, F.C.S., and Geo. M. Thomson, F.L.S., F.N.Z. Inst.

[*Read before the Otago Institute, 8th December, 1925; received by Editor, 31st December, 1925; issued separately, 15th December, 1926.*]

Few problems in connection with the fishing-industry throughout the world are more puzzling than the distribution, migrations, and life-histories of the fishes belonging to the Clupeid or Herring family. Enormous as is their commercial importance, their occurrence is so erratic that it is difficult to regulate or control the trade. Even in Britain where the life-history of the common herring has been closely studied for many years, the migrations of the fish are so irregular and so difficult to predict that the different seasons' catches vary to an extent which frequently leads to financial distress among the fishing population.

In some parts of the world the supply of Clupeids appears to have become permanently reduced, perhaps by over-fishing. Thus in Norway there is a shortage of "brisling"—the Norwegian sardine—to such an extent that enquiries are being made for these fish in many distant countries. Attention has been directed to New Zealand, and it is to call attention to this demand and the possibility of satisfying it that we are led to bring the question into notice.

There appear to be three species of fish belonging to the family Clupeidae in New Zealand waters, viz., *Engraulis antipodum*, or anchovy; *Sardinia neo-pilchardus* or pilchard, and *Harengula antipoda*, or sprat. The two latter are of commercial importance, but little accurate knowledge about them has yet been recorded. The

(1) Reed, Suppl. Mem. Ordov. and Silur. Foss. from Northern Shan States, *Palaeont. Indica*, N.S. vol. 6, Mem. 1, 1915, p. 26, pl. 5, fig. 7.

(2) Raymond, *Bull. Mus. Comp. Zool.*, Harvard, vol. 67, No. 1 (April, 1925), pp. 22–29, pl. 1, figs. 16, 17 (*D. Holdoni*); pl. 6, fig. 9 (*D. contrita*).

various accounts which have been published are so indefinite and mixed up that it is difficult to know in many cases which species is being referred to. There is, indeed, very little difference between them, except perhaps in size.

In several accounts they are referred to by their technical names, and it is almost necessary, in seeking to understand the references, to give the full synonymy of both species as far as New Zealand literature is concerned. It must also be mentioned that in several of the references to herring in New Zealand waters, the common sea-mullet, *Agonostomus forsteri*, is the fish intended, which is not a Clupeid at all, but is allied to the true mullets.

1. **New Zealand Pilchard.**

Sardinia neo-pilchardus Steindachner, *Den. Akad. Wiss.* Wien, 41, 1, p. 12 (1879).

1867. *Clupea melanosticta*, McCoy, *Ann. Mag. Nat. Hist.* (3) 20, p. 188.

1872. *Clupea sajax*, Castelnau, *Proc. Zool. Soc. Vict.*, 1, p. 187; and *Proc. Linn. Soc. N.S.W.*, 3, 355 (1879).

Clupea sagax, Jenyns, Hutton, *Cat. Fishes of N.Z*, p. 63.

Clupea sagax, Hector (not of Jenyns), *Cat. Fishes of N.Z.*,

1879. *Clupea sagax*, Macleay, *Proc. Linn. Soc. N.S.W.*, 4, p. 37; and 6, p. 258, 1882.

1882-83. *Clupea sagax*, Johnston, *Proc. Roy. Soc. Tasm.*, p. 133; and 1890, p. 37.

1883. *Clupea sagax*, Arthur, *Trans. N.Z. Inst.*, 15, p. 208, pl. 34.

1886. *Clupea sagax*, Ogilby, *Catal. Fishes N.S.Wales*, p. 56, and *Edib. Fishes N.S.W.*, p. 180 (1893).

1890. *Clupea sagax*, Lucas, *Proc. Roy. Soc. Vict.*, 2, p. 37.

Clupea sagax, Hutton, *Trans. N.Z. Inst.*, 22, p. 284.

1904. *Clupea sagax*, Hutton, *Index Faunae N.Z.*, p. 51.

1907. *Clupea sagax*, Waite, *Rec. Cant. Mus.*, 1, p. 10.

1908. *Clupea sagax*, Zeitz, *Trans. Roy. Soc. S. Aust.*, 32, p. 294.

1918. *Clupea sagax*, Thomson, *N.Z. Journ. Sc. & Tech.*, 1, p. 8.

1899. *Clupanodon neo-pilchardus*, Waite, *Mem. Aust. Mus.*, 4, p. 53.

1904. *Clupanodon neo-pilchardus*, Waite, *Mem. N.S.W. Nat. Club*, 2, p. 13.

1905. *Clupanodon neopilchardus*, Waite, *Rec. Aust. Mus.* 6, Dl., p. ts.

1908. *Clupanodon neopilchardus*, Stead, *Edib. Fishes N. S. Wales*, p. 95.

1911. *Clupanodon neopilchardus*, McCulloch, *Zool. Res. "Endeavour,"* 11, p. 17.

Clupea neo-pilchardus, Klunzinger, *Sitz. Akad. Wiss.* Wien., 80, 1, DSNO, p. 416.

Clupea neo-pilchardus, Waite, *Rec. Cant. Mus.*, 13, p. 158 and 14, 317.

1921. *Clupea neo-pilchardus*, Thomson, *Hist. Port. M.F. Hatchery*, p. 70.

1915. *Amblygaster neopilchardus*, Cockerell, *Mem. Old. Mus.*, 3, p. 36.

1916. *Amblygaster neopilchardus,* Ogilby, *Mem. Old. Mus.,* 5, p. 98.
Amblygaster neopilchardus, Waite, *Aust. Ant. Exped.,* 3, pp. 56 and 81.
Sardina neopilchardus, Regan, *Brit. Ant. Exped.* Zool., 1, 4, p. 136, and *Mag. Nat. Hist.* 8, 18, p. 14.
1919. *Sardinia neopilchardus,* Stein. McCulloch, *Rec. Aust. Mus.* 12, 8, p. 172, pl. 26.
1921. *Sardinia neopilchardus,* Phillipps, *N.Z. Journ. Sc. & Tech.,* 4, p. 118.
1924. *Sardinia neopilchardus,* Phillipps, *N.Z. Journ. Sc. & Tech.,* 7; p. 191 and figure.

2. **New Zealand Sprat.**
Harengula antipoda Hector.
1872. *Clupea spratus,* var. *antipodum,* Hector, *Edib. Fishes N.Z.,* p.l. 33.
1873. *Clupea spratus,* var. *antipodum,* Hutton, *Trans. N.Z. Inst.,* 5, p. 270, pl. 12.
1883. *Clupea spratus,* var. *antipodum,* Arthur, *Trans. N.Z. Inst.,* 15, 203, pl. 34.
1886. *Clupea spratus,* var. *antipodum,* Sherrin, *N.Z. Fishes,* p. 92.
1890. *Clupea spratus,* var. *antipoda,* Hector, Hutton, *Trans. N.Z. Inst.,* 22, p. 284.
1904. *Clupea antipoda,* Hutton, *Index Fanuae N.Z.,* p. 51.
1907. *Clupea antipodum,* Waite, *Rec. Cant. Mus.,* 1, p. 10.
1911. *Harengula antipoda,* Waite, *Rec. Cant. Mus.* 1, p. 160
1912. *Amblygaster antipodus,* Waite, *Rec. Cant. Mus.,* 1, p. 317.
1916. *Clupea holodon,* Regan, *Ann. Mag. Nat. Hist.,* ser. 8, vol. 18, p. 5.
1917. *Clupea antipodum,* Regan, *Ann. Mag. Nat. Hist.,* vol. 19, p. 227.
1921. *Amblygaster antipodus,* Thomson, *Hist. Port. M. F. Hatchery,* p. 70.
Clupea antipoda, Phillipps, *N.Z. Journ. Sc. & Tech.,* 4, p. 118.

In McCulloch's *Check List of N. S. Wales Fishes,* p. 16, will be found a key to the Clupeidae. This gives the generic characters as the same for both genera, with the slight exception that *Sardinia* has several radiating grooves on the operculum, whereas *Harengula* has only one. This characteristic can be noticed in Arthur's outline drawings (Trans. 15, p. 208), but it is difficult to notice in the specimens themselves. It is better to judge by the contour of the body, the sprat being deeper and more rounded in the belly than the pilchard. Indeed the total differences are so small, that it is only by careful comparison that one is able to distinguish which is which. The sprat is the smaller of the two, but in the numerous notices of these fish, the name " sprat " probably includes in many cases immature pilchards.

The following extracts refer chiefly to pilchards. P. Thomson in " Fish and their seasons," (*Trans. N.Z. Inst.* 9, pp. 484-490, 1876) says:—"A true herring visits the coast (of Otago) in immense pro-

fusion in the autumn. The time of their arrival is uncertain, and is only known by the great flocks of birds which attend the shoals." In 1877 (*Trans.* 10, pp. 324-30.) he says—" The herring (*Clupea sagax*) was brought to market in good quantity in Junuary. Some specimens measured 11 in. long; the average were about 9 inches. On several days in the middle of February the fish were again in the market." He adds—"The true herring is a migratory fish, when it is present in immense shoals. Those brought to town varied from 7 to 11 inches in length." In the following season, 1877-78, no Clupeids were reported in the Dunedin market.

W. Arthur, in notes on " the Picton herring," (1883) says the fish seem to inhabit Queen Charlotte and Pelorus Sounds throughout the whole year. Quoting Mr. Fell—" they are not easy fish to find unless they are rushing to the surface, which is not often, and which is a most peculiar sight... They come into the shallow bays during the winter. At that time of the year they keep together in large shoals and prefer colder water. They spawn during the summer and are always full of roe about Christmas time, when they keep in small shoals." Arthur gives line drawings of the Sprat 4½ inches long, and of a Pilchard about 10 inches long.

Hector says of the Pilchard—" this is the true representative of the herring kind in New Zealand," and is reported to visit Otago coast every year in February and March. " On the last occasion it was observed that the shoal was migrating southwards and extended as far as the eye could reach, followed by a multitude of gulls, mutton birds, barracouta and porpoises. So densely packed were the fish that by dipping a pitcher in the sea it would contain half fish." Later in the same work (*Edible Fishes of N.Z.*) he remarks that a herring cast up on the beach in Foveaux Strait, and a second smaller one obtained near Wellington, prove to be a different fish, hardly distinguishable from the European sprat.

In a paper on these and other fishes observed by lighthouse-keepers on the New Zealand coast, G. M. Thomson reports in 1891, —"The recorders were mostly unable to distinguish between these species. They are only noted from Moeraki, Catlin's River, Waipapapa Point and Milford Sound, but at these localities they occurred at certain seasons in enormous quantities. From Moeraki they are only reported as occurring in March in enormous abundance. In the Catlins River estuary they were found in numbers in the rock pools in June, the larger ones with the ova well advanced. From Waipapapa Point they are recorded by Mr. Ericson as passing continuously through Foveaux Strait from November to April, usually pursued and driven ashore in great numbers by the mutton-birds. In January the ova were nearly ripe in many of the fish, while of those taken in April, some of the fish carried ripe ova, and some had spawned. In Milford Sound these fish were reported as occurring all the year round, being frequently driven ashore by cow-fish and other enemies. Their abundance is testified by entries like the following:—"December, 1885. Tons of pilchards thrown up on the beaches at the end of this month." Fish taken in October had the ova nearly ripe, while for two years in succession they were found to be spawning during November and December.

Phillipps reports that "during the month of July, 1924, Wellington Harbour was visited by an enormous shoal of Pilchards or Sardines (*Sardinia neopilchardus*)."

The occurrence of this fish in Australian waters is as erratic as it is in New Zealand. McCoy recorded their occurrence in Hobsons Bay in August, 1864-66. They arrived in such countless numbers that carts were filled with them simply by dipping them out of the sea with large baskets. Hundreds of tons of the fish were sent to the inland Victorian markets, and they were sold in Melbourne for several weeks by the bucket-full for a few pence. Captains of ships entering Hobsons Bay reported having passed through shoals of pilchards for miles. Macleay in 1869 ascertained from the fishermen that their annual visit to the New South Wales coast was about June and July, when enormous shoals were generally observed one to three miles from the land, and migrating northwards. According to Stead (1908) shoals of mature pilchards, 9 to 10 inches long, are usually making northwards along the New South Wales coast in September, and small bodies of these are often found among mackerel of equal size.

On the east coast of Australia the pilchard ranges from Tasmania northwards to Moreton Bay and Harvey Bay in Queensland, and also occurs in West Australia.

The references to the sprat are even more fragmentary and of more doubtful accuracy than those to the pilchard. It is recorded by Hector from Foveaux Strait and from Wellington in 1872. In Otago it was reported by Arthur as appearing near Oamaru close inshore in May, 1882, for about a fortnight. Then bad weather set in, and the fish disappeared. The shoals were not seen at Moeraki, nor near Dunedin. Arthur gives a mass of interesting information obtained from Messrs. Stoddart and Cosgrove, but it is more probably referable to pilchards than to sprats. It deals chiefly with the enormous shoals of these fish which occur on the coast. Waite, in his account of his trawling cruise along the east coast says of *Harengula antipoda*:—"This herring was taken along the whole of the coast line explored, though it is improbable that it was trawled from the bottom, the specimens being more likely entrapped as the net was hauled to the surface. Hundreds were washed through the large meshes, all appearing to be dead, their delicate bodies being unable to withstand the pressure to which they were subjected. Most of the samples preserved were skimmed off the surface with a hand net." Captain Bollons obtained the same species in Auckland Harbour.

In consequence of enquiries from Britain as to the possibility of obtaining brisling or sprats from this country, it was decided two years ago by the Board of the Portobello Marine Fish Hatchery to examine the position on the east coast of Otago. Special drift sprat-nets were obtained from Britain, and every week when the weather permitted, the launch went outside of Otago Heads in search of these elusive fish. In September, 1923, both species were taken in the seine-net inside the harbour; in July, 1924, sprats only were taken in the bag of a trawl on the bar; and in June, 1925, both species were found in abundance in the stomachs of red cod. Only

once in these two years has a shoal been seen on the surface, and then for such a short period of time that it had disappeared before the net could be shot. Reports have been received from time to time of the occurrence of these fish at Cape Saunders and the Nuggets, but there has been no confirmation of these rumours.

In the case of fish-stomachs examined at the station, sprats have been found in red cod, blue cod, southern king-fish, barracouta, and spined dog-fish; and pilchards in barracouta. The examination of other records would seem to show that both species of fish occur more or less permanently all the year round in the West Coast and Marlborough Sounds, and perhaps all round the coast, but that they only come to the surface when disturbed by some enemies; that they move along the coast at times in enormous shoals, usually between November to April, but most commonly during January to March; that this movement is most erratic, sometimes no fish being recorded for two or even three seasons; and that the shoals are harassed continually by porpoises, such predatory fish as barracouta, and countless flocks of sea-birds. What causes these migrations is a matter of conjecture. Clupeids are known to feed chiefly on free-swimming Copepoda, and these in turn depend upon diatoms, Peridineae, and other minute forms of vegetable and animal life. Therefore every investigation into the occurrence and movements of these fish must be preceded by an examination of the conditions of the sea, and the occurrence in it of these smaller forms.

The routine work of the station at the Portobello Fish Hatchery for the future is to include regular observations on (1) the temperature and (2) the salinity of the sea in the sub-antarctic current which sweeps in a north-easterly direction along the coast to the east of Otago, and (3) the collection of tow-net material at the same time that the hydrographical observations are being taken. When shoals are met with the size and direction will be noted, the size of the fish, the condition of the reproductive organs, and the stomach-contents will be recorded, and specimens preserved. The regular work of the station has always included the examination of the stomach-contents of the fishes taken, and this will be continued in the future. The drift of the current has been observed by means of a drift-bottle experiment which was carried on for a considerable period, but the rate of movement has never been estimated by observation since Captain Stokes made his survey of the coast in 1840.

As opportunity offers the scope of these observations will be extended both north and south, and other observers secured to assist in the research. Ultimately it is hoped to obtain an amount of accurate information on which will be based some estimate of the possibility of establishing an industry in the capture and utilization of these fish. At present it is clear that no definite statements can be made. The problem illustrates the importance of systematic and careful scientific investigation of marine conditions, and this is work which should be undertaken by all the States of Australia in conjunction with New Zealand. By co-ordination of scientific effort success in this and similar investigations is most likely to occur.

A Further Commentary on New Zealand Molluscan Systematics.

By H. J. FINLAY, M.Sc.*

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TWELVE years ago Iredale wrote a "Commentary" on Suter's "Manual of the New Zealand Mollusca" (*Trans. N.Z. Inst.*, vol. 47, pp. 417-497, 1915). Many subsequent notes were drawn up by him in connection with the collection in the British Museum (Natural History), but the war prohibited any sustained study and consequent publication. Examination of Roy Bell's Australian material developed a few cases of Neozelanic interest, and some have been published in the Report on the Twofold Bay collection (*Proc. Linn. Soc. N.S.W.*, vol. 49, pp. 179-278, 1924), hereafter referred to as "Iredale (1924)". In 1923 Iredale returned to Australia, and his intensive collecting around Sydney has been instrumental in indicating some relationships not previously recognized.

For some years the present author has been studying Recent and fossil New Zealand Mollusca, and many series of lineage forms linking up fossil and Recent shell-groups have been determined. Data have been procured proving the ancient development and separation of apparently closely-related Recent forms, and I would endorse Martin's dictum, "The species with which one has to deal in palaeontology are no physiological but morphological species. The individuals of such species of mollusca . . . agree in a single anatomical element, the shell. Such an agreement may exist, however, while other elements are absolutely different." (Martin, 1917). One may cite in illustration of this the heterogeneity of the Minolioid shells, the Buccinoid Mitras, and especially, in connection with New Zealand species, the case of *Diloma nigerrima* Sow., considered later.

Little close relationship in Recent times is determinable between the east Australian and Neozelanic molluscan faunas, relations whenever recognized being usually with the latter and Tasmanian species. A "List of Recorded Relationships between Australian and New Zealand Mollusca," dealing chiefly with the fossils, has

*As originally presented, this paper was under the joint authorship of T. Iredale and H. J. Finlay. It had been suggested and written by the latter after verbal discussion and some correspondence with Mr. Iredale, to whom it was subsequently submitted for revision and extension. Pressure of other work, however, unfortunately prevented Mr. Iredale from carrying out this part of the undertaking, and it has accordingly been agreed that the paper shall appear under a single name. The writer must therefore take all responsibility for its shortcomings, and desires to acknowledge his indebtedness to Mr. Iredale not only for some of the ideas and suggestions contained therein, but also for his generosity in permitting the publication of the paper in its present form.—H. J. F.

been published (Finlay, 1924G), but owing to the great confusion existing in connection with palaeontology in Australia, such correlation as may be necessary cannot safely be undertaken for many years. Apparent conchological affinities have proved on closer examination to be due to convergence only, and not to be radical. One may note in this connection the statement made by Marwick (1924, p. 330) that "In correlating Australasian Tertiary strata the stratigrapher will therefore have to deal with generic correspondence and specific resemblances rather than with spêcific identities." A recent visit to Australia, and the collecting and study of museum collections at Adelaide, Melbourne, and Sydney thus made possible, suggested to me the reconsideration of relationships previously, under the influence of earlier workers, taken for granted. A stay in Sydney where, with the material and literature available at the Australian Museum, the main points were discussed with Mr. Tom Iredale has led to the production of this paper, the principal features of which are the rejection of bad records, the proposition of new group-names for Neozelanic forms, and the indication of systematic and other errors. The group-names here introduced as generic may be regarded as such until a fuller appreciation of further material exactly valuates them. I note, in passing, Dr. J. Allan Thomson's opinion, "Some students object to the process of minute distinctions between genera, mainly on the ground that it renders the study more complex, and a matter only for the specialist. But the narrower definition of genera, if it is based on phylogenetic grounds, prevents the assimilation of apparently similar but historically distinct forms, and for the purpose of discussing geographical distribution and geological correlation becomes an instrument of the utmost utility." (Thomson, 1918, p. 53).

It may be understood also that, unless statement is made to the contrary, wherever reference is made to any species, I have studied either the actual type specimens or, when these were not available, topotypes of the species. The Tertiary and Recent types in the Dominion, Canterbury, and Otago Museums, and the New Zealand Geological Survey collection have been at all times readily made available for study, and I here desire to record my thanks to the curators and others in these institutions who have made this possible. Unfortunately, the types in Suter's own collection—now in the Wanganui Museum—are not so readily available. My own private collection, however,—a practically complete topotypic suite (and perhaps the largest yet made) of New Zealand fossil and living mollusca—has enabled me to overcome almost every difficulty in regard to types.

Since the publication of Suter's "Manual," workers have, as Iredale anticipated, been busy in connection with Neozelanic molluscs, and the keen interest shown by the younger workers is a great tribute to Suter's monument. Errors in Suter's work are found to be numerous, but when the magnitude of the work is contrasted with the many disabilities of the worker, in lack of both specimens and literature, Suter's accomplishment is prodigious. It is possible that if such a work were available to Australian conchologists more interest would be evinced, when at the present time the older

generation, Hedley, Verco, May, Pritchard, Gatliff, and Gabriel, seem to have no successors. The enthusiastic band of workers, (Allan, Brookes, Bucknill, Marwick, Miss Mestayer, Oliver, and Powell) at present in New Zealand is the best tribute to his work Suter would have desired, while the passing of Murdoch leaves a blank which one may hope to see filled, perhaps by still another student.

It has been the habit of austral palaeontologists, following Tate and Cossmann, to look for the affinities of austral shells, Recent and fossil, principally in the beds of the Paris basin—partly because the assemblage there exposed is so rich in generic forms, and partly because the many local workers and their possession of abundant illustrative resources have made that fauna so well known —but I believe that until the lineage of austral forms is definitely determined, such association will prove futile. An excellent example of the lengths to which exotic comparison may be carried is provided by Wilckens, who has remarked of the New Zealand Upper Senonian *Calliostoma decapitatum* Wilckens that "it is only to be compared with the living *C. zizyphinus* L. from the Mediterranean Sea, which very much resembles our species. Certainly this resemblance of a Cretaceous shell from New Zealand to a living form from the Mediterranean is surprising" (*N.Z. Geol. Surv. Pal. Bull. No. 9,* p. 5, 1922). This writer also compares his *Protodolium speighti* from the same beds with the living *D. galea* L. because of a resemblance in external sculpture; all these comparisons are made quite confidently in spite of the fact that the New Zealand fossils are crudely preserved and imbedded in hard matrix—such work calls for no comment. Etheridge is quoted by Benson (1923, p. 47, footnote) as approving of Uhlig's principle, "I do not consider it wise to identify a form with a species described from a region thousands of miles distant, unless the agreement is so close as to leave no room for doubt as to their identity," and Hedley wrote even in 1899 (p. 416) "Our increased knowledge develops distinctions more than affinities between the Central Pacific and the Tropical Atlantic." The examination of the living species of Australia has shown so much discord with the living European forms that only more confusion must ensue if the attempt to use European group-names for austral fossils be pursued further. So much splitting has been done (probably correctly) in connection with European fossils by specialists such as Cossmann and Sacco, that a host of names has accumulated, and any attempt to utilize such names would necessitate autoptic examination of authentic series of specimens by each worker, with probably different results in every case, due to the personal equation. Cossmann's work, because of his peculiar method of type selection, is difficult to comprehend, and the rejection of the whole of his extra-austral group-names would lead to less error than the attempted recognition of superficial resemblances, due more to convergence, chance similarity in the combinations of dominant and recessive factors, and like response of organisms to like environment, than to any real genetic (and therefore generic) relation other than, perhaps, common derivation from an ancient stock. In many of the cases in which Coss-

mann has provided data in connection with austral species he has been peculiarly unfortunate in his judgment of their affinities.

There are very strong geological and geographical reasons for the step I propose to take, and as much literature bearing on this point has accumulated within recent years, one may note here the views of some of the geologists, palaeontologists, and zoo-geographers who have dealt with these problems. Especially may one recommend study of the many important papers and summaries by Benson and K. Martin, and of the "Proceedings of the First Pan-Pacific Scientific Conference, Part 3."

It is to Suess that we owe the conception of the Tethys Sea—an ancient vast waterway that occupied the area now covered by the Gulf of Mexico, the Mid-Atlantic, the Mediterranean, and Southern Asia, and practically divided the dry land of much of later Palaeozoic and Mesozoic time into two huge continents, a Palaearctic northern mass, and the austral "Gondwanaland," including Peninsular India. This period saw more or less free migration of forms to all the shores of Tethys, but with the breaking up of this immense Mediterranean the differentiation and localization of faunas proceeded apace. "The community of character of forms on either side of the Pacific was very marked in Lower Triassic times, indicating an intimate connection of the two regions, which became interrupted during the crust movements of Middle Triassic times. (Smith, 1904). We see, therefore, that the extension of the Tethyan coast to New Caledonia, but not to New Zealand, was a feature of Lower Triassic as well as of Permian times... As in New Zealand, so in the Malay Archipelago, the sea retreated early in the Cretaceous period, and great orogeny followed..... The last remnant of the Tethyan Sea was driven out from the region by these movements. Except for a few forms, the immigrant fauna appearing later in Cretaceous times was of the Indo-Pacific type*... at the close of Mesozoic times the various portions of Australasia ceased to have any striking unity of geological history. The fragmentation of the region became more active, and extending subsidence blocked it out into geographical elements, the remnants of which are now visible. These appear to have had very diverse histories during the Tertiary period,.... and to have developed provincial faunas with little intermigration."† (Benson, 1923, p. 38 *et seq.*)

K. Martin (1914, pp. 732-734) has discussed the question "When was the Indian Archipelago separated from Tethys?"‡, and, but for

*"Up to this time (late Jurassic) the successive faunas were all closely related to Malayan and Tethyan faunas in general, with some circumpacific elements, but now significant changes took place.... The new immigrant fauna (Senonian) was distinctly of the Indo-Pacific type, and apparently had a definitely marked affinity with that of New Zealand and the American Antarctic regions."—(Benson, 1924, p. 124.)

†Workers have hesitated to unite even Silurian austral fossils with superficially similar Northern forms. Thus, as regards corals, Benson (1923, p. 25, footnote) has noted that "Yabe is, however, inclined to explain the similarity of the Canadian, Baltic, and Australian forms (of *Halysites*) as the result of parallel evolution under analogous conditions from a common stock, rather than by a continuous intermigration of derived forms."

‡My thanks are due to Dr. Benson for kindly translating this paper from the original Dutch.

lack of space, his conclusions would here be quoted in full. He states that the East Indian-Philippine Tertiary deposits, extending from Eocene to Pliocene, are "stamped with a remarkable petrographical and palaeontological uniformity....one must conclude that during the whole period subsidence of the Indian Archipelago took place. It does not follow from this that this geosyncline was in connection with the Mediterannean Sea, the Tethys in the Tertiary period, or that a connection existed between Europe and the Indian Archipelago. All the faunal studies can give decisive evidence on this point. The fauna of the Eocene of Nanggulan in Java differs indeed completely from that of Europe....In the Neogene the differences are still greater....It follows that already during the deposition of the Nanggulan sediments....Java of the present day was no longer connected with Tethys, and the communication was not renewed at a later date....There is not the least reason to consider, as Noetling does, that the Eocene fauna of Europe had migrated to India. Apart from some interchange of species between neighbouring areas, one may consider the Tertiary fauna of the Indian Archipelago as autochthonous in the main." All these remarks apply with redoubled force to the far more isolated and much more distant province of New Zealand. In a later paper (1917, p. 801) the same author remarks, "From the Neogene fauna of Europe the (Lower Miocene) mollusca of the West-Progo Mountains (of Java) are entirely different....they clearly present an Indo-Pacific character....the whole character of the Tertiary fauna of the West-Progo Mountains is in complete agreement with the theory formerly developed by me, according to which the Javanese sea was separated from the Tethys since the Upper Eocene." It is the opinion of Wayland Vaughan (1921, p. 868) that "tracing from Europe to south-eastern Asia is possible for early Eocene, but it is not possible for later Eocene, Oligocene, and Miocene times." And again (p. 720), "The connection between the Pacific and Atlantic by way of Tethys appears to have been closed before latest Eocene times, and perhaps except for transitory communication there has been no connection across Central America between the two oceans since older Miocene time. Marshall's insistence on the isolation of the New Zealand fauna appears to me to be fully warranted."

The foraminifera one would expect to be more widely dispersed and to afford less definite information than the mollusca, but they nevertheless give evidence of a definite stage in the breaking down of the eastern margin of Australasia. The study of the Eocene foraminifera of New Caledonia by Piroutet and Deprat shows that they belong to a characteristic fauna which may be traced through New Guinea to the Malay Archipelago, and contains as one of its components some forms as yet indistinguishable from European species. This fauna is, however, quite unrepresented in New Zealand. (See e.g., Benson, 1924, p. 125.)

The case of the Brachiopods has been stated by Thomson (1918, pp. 37-61). The convergence of many lines of evidence has led to the conception of Gondwanaland, "a congerie of continental masses

lying south of the Tethys at the close of Palaeozoic times." (Benson, 1921, p. 57). Thomson has argued for the genesis of the southern stocks of Brachiopods almost solely on the shores of this old continent; "The most obvious explanation of all the above facts is that these two groups of the *Terebratellidae* originated on the coasts of Gondwanaland, on the remnants of which they now survive, and to which they are almost restricted." Though the dispersal of marine mollusca is more complex, by reason of different habits and embryonic stages, there appears to be little reason to doubt that this hypothesis will apply also to very many stocks of southern mollusca. Thomson remarks further, "The distribution of southern Recent Brachiopods, then, is satisfactorily explained by an ancestral distribution in the Miocene, and not only does it not call for any land bridges or shallow submarine connections between the various southern continents and islands since that date, but is distinctly opposed to any such means of intercommunication except between South America and the Antarctic....The fact that the Gondwanaland element occurs both in New Zealand and Australia, but not in the Antarctic and South America, suggests that the intercommunication between New Zealand and Australia did not occur at the same time as that between New Zealand and the Antarctic, but that the latter was the earlier.... The circum-Pacific southern connections were all broken much as at present by the Miocene, and since that date there have been no renewed connections between the southern continents and island districts, except possibly between South America and the Antarctic and the adjacent islands." Hedley (1899, p. 398) has in like manner dealt with the distribution of mollusca along these ancient highways; "A centre of distribution has been described for New Guinea; another such occurs in New Zealand....Along the tortuous route by which the Malayan forms crept south to New Zealand from New Guinea, there flowed a return current of Antarctic life....It is to be noted that the Antarctic fauna which passed over New Zealand is quite distinct from, and probably far older than, that other Antarctic element, the Euronotian, which reached Australia through Tasmania." Tillyard, too, in treating of insect faunas, has quite recently (1924, pp. 407-413) stressed the fact that Antarctic connections with Tasmania and New Zealand were not synchronous, and that because of this time difference considerable dissimilarities in their faunas have arisen. "We are struck with the very great differences not only in the types of insects which reached Tasmania and New Zealand respectively about this time (early Tertiary), but also in the associated flora and fauna. This leads us to postulate two separate connections with Antarctica in early Tertiary times....Tasmania, however, holds the largest share in the immigrants received through the Antarctic connections, and this gives its fauna its somewhat remote relationship with that of New Zealand."

Benson (1922, p. 60) has noted that "there is, however, no divergence of opinion in regard to the isolation of New Zealand since the middle of Tertiary times....this seems to preclude the possibility of the formation of a temporary association of lands during the late Tertiary and Pleistocene orogenic and epirogenic movements in New Caledonia, New Zealand, and Eastern Australia, to which Cockayne

(1919) seems to be inclined to ascribe the entry of a presumably post-Mesozoic floral element in New Zealand." Though it is certainly true that the great majority of both New Zealand and temperate Australian mollusca have Tertiary ancestors, nevertheless the collector who has access to both Recent and Tertiary Australasian shells notices at once that apparently the Recent faunas of Australia and New Zealand are far more closely allied than are those of the "Miocene." Finlay, in discussing New Zealand Tertiary *Cymatiidae* (1924A, p. 465), has noted "The fact that none of our Tertiary species occurs in Australia is all the more significant since all our Recent species occur there*....the only explanation is that very different conditions were brought about for a short time after the close of the Wanganuian, and allowed the passage of characteristic Australian forms into our waters." It should, however, be emphasized that the Recent faunas and those of the Tertiary are not directly comparable, since one of the most important elements of the Recent faunas—the conspicuous littoral and shallow water forms—is totally absent from almost all Australasian Tertiary faunas. A possible reason for this resemblance between the Recent faunas lies in the ocean currents. At Shell Harbour, some 80 miles south of Sydney, an insweeping ocean current brings to that one neighbourhood many typical Queensland forms, whose presence would be otherwise inexplicable. In like manner, the same Notonectian† current, sweeping southwards far past Tasmania, and then up the coasts of New Zealand, is probably responsible for the introduction of many forms of Maugean (i.e. East Tasmanian) affinity. Introduction by this means within quite recent times seems the most feasable explanation of the occurrence on New Zealand shores of most of our present *Cymatiidae,* and the few other species apparently identical with Peronian, Adelaidean, or Maugean forms. It is not known how long the influence of the Notonectian current has been at work, but it is quite possibly of recent development, and to the absence of this factor may be partly due the appearance of so very few Australian fossils in New Zealand Tertiary beds, as compared with apparently greater resemblances in the Recent faunas. Ashby (*Rep. Austr. Assoc. Adv. Sci.*, vol. 17, p. 371, 1926) has lately invoked the aid of ocean currents to explain the distribution of Australian chitons.

I have quoted the geological evidence at some length, partly because it forms a very stable foundation on which to raise a zoological and palaeontological superstructure, partly because the treatment of the New Zealand fauna as autochthonous would be only half justified without some indication as to its origins‡ and how it may have become modified by migrations from other sources, and partly because

*As will be seen later some of the New Zealand forms are represented in the Australian faunal provinces really by regional variants and not identical species; this, however, does not alter the relative closeness of affinity between the fossil and the Recent assemblages.

†Name proposed by Hedley (*Proc. Linn. Soc. N.S.W.*, vol. 35, 1910); rejected by Halligan (*Proc. Roy. Soc. N.S.W.*, vol. 55, p. 193, footnote, 1921). It is, however, a convenient term for an important distributional factor.

‡It should be well understood that indications alone are outlined here; the recognition of the distinctness of a fauna need not await demonstration of the actual origin of all its component parts.

the "Tethys sea," "Gondwanaland," and such like fundamental concepts convey unfortunately but little meaning to many neontologists and systematists. Yet they form an indispensible basis for the accurate tracing of faunal relationships, seriation lines, and " natural " genera in austral lands.

I propose, therefore, to deal with the Neozelanic molluscan fauna, Tertiary and Recent, as an entity, comparable only with Australian (and South American) species, and believe that European fossils should be given less consideration until a later date. Bather, in his Presidential Address to the Geological section of the British Association for the Advancement of Science at Cardiff in 1920, dealt with "Fossils and Life," an essay of even more importance to the systematic neontologist than to the members he addressed. Therein he sketched the difference between the work of the Palaeontologist and that of the Neontologist. The effect of the time-concept on principles of classification should be used as an introduction to all systematics, and it is important to emphasize the fact that lineage is the all-important concept. Dall has written of "Two groups which are represented side by side in all the Eocene horizons and still have representatives in the Recent fauna....These distinctions seem hardly of sectional value....The estimation of values in such cases is liable to a large personal equation, but it seems to me that historical and stratigraphical palaeontology will be benefited by regarding the differences as of subspecific rather than specific value." I would disagree entirely with this dictum, and would rather suggest that the fact of such differences remaining throughout so long a lineage is of itself sufficient evidence that probably not different subspecies but different genera are represented. When two superficially similar forms live side by side, the balance of probability is either that they are not closely related, or else that they represent a period of variation in the lineage of the genus alternating with more fixed species of the line directly preceding and following the variable "species."

Owing to the splendid series of fossiliferous horizons now known, in Neozelanic palaeontology it is almost always possible to secure series showing lineage down to existing forms. Dr. Allan Thomson has expressed the opinion that in connection with Neozelanic palaeontology "One (line of advance open) is the more detailed study of the species on evolutionary lines (such as I have been attempting in the brachiopods and limpets) with a view to defining valid species of limited range, and to arranging the species in evolutionary order." One may endorse this dictum, and add that the study of Recent forms, especially as to their variation geographically and bathymetrically, should precede palaeontological decisions. It must be emphasized that, as regards Mollusca at all events, there can be no Palaeontologist ignorant of Neontology, nor can the Neontologist safely determine faunas without recourse to Palaeontology*, yet in the past the two branches have been commonly treated as if they were distinct and alien subjects.

*Cf., for example, in the notes that follow, the cases of *Leucosyrinx thomsoni* Mestayer and *Cerithium invaricosum* Odhner.

If, therefore, lineage can be traced for a shell form back through the Tertiary, I propose to regard that group as of generic or at least subgeneric value, whether the group is represented by only one living species or by many. Where available, however, the living forms should first be studied, and the fossils then classified conchologically in seriation. Many cases will arise where the radular or opercular features of the living species will command a higher value than the conchological features.

As a means of indicating by nomenclature the recognition of seriation and lineage among mollusca, Iredale has proposed the use of trinomials of varying kinds (*Proc. Mal. Soc.*, vol. 15, p. 37, 1922), and this method seems to be of great value, there being many instances where its application obviates useless discussion as to the exact status of the affined molluscs, and a digest may be here given as applied to the Maorian Sub-Region.

Regional names in connection with Australian marine molluscs have proved of great value, and consequently the proposition of similar names for New Zealand is simply a matter of form. I have already (*Gedenboek Verbeek,* p. 168, 1925), following a MS. scheme of Iredale's, subdivided the Maorian Sub-Region into five provinces, as follows:—

Kermadec Province	......	Kermadec Islands
Cookian Province	......	North Island of New Zealand
Forsterian Province	......	South and Stewart Islands
Moriorian Province	......	Chatham Islands
Rossian Province	......	Subantarctic Islands, including Macquarie Island

Ornithologically these provinces may be distinctly characterized, botanically they are quite separable, structurally there are differences*, while conchologically the data is strong and important. I make the proviso, however, that the Cookian and Forsterian provinces as here defined may not be "natural" and may be subdivisible later—in which case the present names are to be retained for the southern portions of each island. Cook Strait has been adopted as a temporary dividing line purely for present convenience; many characteristic regional forms are known to range across it. The quite recent development of Cook Strait as a geomorphic feature may account for this. Cotton (1916, pp. 248, 319) has written that "The orogenic movements which followed the Tertiary deposition, and to which the present relief is entirely, or almost entirely, due, must have occurred in or about the Pliocene period....Faults of late date appear also to have determined the outlines of at least some parts of the New Zealand coast, especially in and about Cook Strait." And again in a later paper (1918, p. 325), "This justifies the adoption of a tentative hypothesis that at the close of the orogenic movements which gave birth to the New Zealand land mass, the dividing strait was not in existence, and that the separation of the two islands has taken

*Cf., for example, Cotton (1918, p. 324), "The close political association of the two (main) islands is a result, no doubt, of their isolation from the rest of the world: it has come about in spite of striking physical differences between them."

place subsequently, as a result of subsidence of blocks, possibly contemporaneous with the partial subsidence of an adjacent portion of the South Island." Cockayne (*Trans. N.Z. Inst.*, vol. 39, p. 313, 1907) and lately Myers (*l.c.*, vol. 56, p. 455, 1926) have also noted in the case of plants and heteroptera respectively that "Cook Strait forms no line of demarcation." The former author has placed a boundary at latitude 42°S., that is, near the Clarence River. It is preferable, however, to create Regional names only where justifiable on present evidence; north of Hauraki Gulf there may possibly be a different provincial region (the Cape Maria van Diemen fauna seems notably distinct); some of the most marked Forsterian forms are traceable only as far north as Shag Point; and the molluscan fauna of the South Island north of Banks Peninsula is too indefinitely known to permit of analysis;—on the facts available I nominate Cook Strait in the meantime as a dividing line between two certainly distinct provinces, the great bulk of the North Island, and the Southern portion of the South Island, and anticipate that future research will provide more exact limits.

The Kermadec Province has been well discussed in these *Transactions,* thanks to Oliver and Iredale. The results of study of Chatham Island mollusca will be published at an early date—but it is pertinent to mention the significant fact that the further one goes back into the Cainozoic record there, the more does its fauna differ from that of the other provinces. The Cookian Province shows a series of northern mollusca which are absent from the Forsterian, and the latter has many forms allied to Rossian species which never reach the Cookian Province. And Hedley, from consideration of Antarctic and Subantarctic mollusca has observed, "The Subantarctic Islands differ in their marine fauna from Antarctica almost as much as they do from such temperate zones as those of New Zealand or Tasmania." The mollusca collected by members of the Mawson Antarctic Expedition were reported upon by Hedley in 1916, and included a collection from Macquarie Island which added to the known fauna many new species and records, all of which are discussed or mentioned in this paper. The circumpolar range allowed for some of the Subantartic species needs re-consideration, for when series are examined valid differences are easily observed.

Where a species occurs in more than one Province, it will generally be found to differ subspecifically, and here ordinary trinomials may be used. When the form varies bathymetrically to such an extent that it becomes an arguable point as to its specific identity or distinction, a trinomial is used with the second name enclosed in simple brackets. When a fossil is found so closely related that its specific distinction is indefinite, and its Recent relation indubitable, a trinomial may be used, the second name being enclosed in square brackets. As a concrete example, the various forms of *Thoristella* may be taken as well illustrating this scheme:—

Thoristella chathamensis chathamensis (Hutton)	Moriorian Province
Thoristella chathamensis dunedinensis (Suter)	Forsterian Province
Thoristella chathamensis oppressa (Hutton)	Cookian Province
Thoristella chathamensis aucklandica (Smith)	Rossian Province

Thoristella (chathamensis) benthicola n. sp.*	Deep water in some Province (Forsterian in this case).
Thoristella [chathamensis] fossilis n. sp.*	Tertiary ancestral species.

This scheme can be enlarged in any way, as the deep water form could be referred to in the Cookian Province as *Thoristella (oppressa) benthicola;* and a species older than *fossilis* could be described as *Thoristella [fossilis] profossilis* n. sp.

It may be noted that on the occasion of the first introduction to New Zealand of a trinomial system (Matthews and Iredale, "A Reference List of the Birds of New Zealand"; "*Ibis*" for April and July, 1913), one austral zoologist expressed his hearty commendation of the scheme, and its advantages cannot be better told than in his words: "It will be seen from a few examples that this is a very useful innovation, in that it indicates at once the close affinity between the different forms or subspecies of one and the same species which inhabit the different islands that constitute the New Zealand area. Systematic work in all groups nowadays is more and more closely correlated with geographical distribution than it used to be; and as classification is the espression of genetic relationships, the utility to the evolutionist of this trinomial system becomes manifest." (Benham, *Trans. N.Z. Inst.*, vol. 46, p. 189, 1914). I could not better epitomize my views and close this introduction than with these words.

The types of all new species described are in the Finlay collection; paratypes wherever possible have been deposited in the Australian Museum, Sydney.

All new genera proposed for New Zealand shells, or newly added to the fauna, and all additions made to the Recent fauna since the publication of Suter's "Manual," also all notes of interest on already described species, and references to most of the fossils (all, since 1922 inclusive) described since the publication of *New Zealand Geological Survey Palaeontological Bulletin No.* 5, 1917, will be found in this paper, which aims at being not only a more or less exhaustive revision, but also a work of reference to the scattered and now fairly voluminous molluscan literature which has accumulated on New Zealand forms since Suter's death. It is sincerely hoped that in both these categories it will prove useful.

Order POLYPLACOPHORA [P. 3]†

Iredale and Hull have published a "Monograph of the Australian Loricates" in the *Australian Zoologist*, the plan of which for accuracy, clearness of treatment, and general utility to both tyro and specialist it would be difficult to better. The general account of "Systematics and Structure" forming No. 1 (*Austral. Zool.*, vol. 3, pt. 5, pp. 186-194, 1923) is the introduction *par excellence* for any student starting work on this interesting group. Therein it is shown (p. 186) that the name *Polyplacophora* Gray, 1821, the

*Described later in the paper.

†As in the "Commentary," the references in square brackets give the page of the "Manual" referred to, and, also as before, the names at the head of the paragraphs are not always those used by Suter.

usage of which was based on priority, must give way to that of *Loricata* Schumacher, 1817, and they have suggested the use of the vernacular "Loricate" in preference to "Chiton," which is the name of one of the genera of the *Loricata**. Their classification differs a little from that used by Suter, and also from that of Thiele, recorded in the "Commentary" by Iredale (pp. 423-426). The new arrangement may be condensed thus: the suborder *Lepidopleurina* Thiele is abolished, as all the Lepidopleurids appear to be degenerate forms only (No. 4, p. 339), and nine families are admitted (No. 1, p. 193):—*Ischnochitonidae, Lepidopleuridae, Lepidochitonidae, Callistochitonidae, Loricidae, Cryptoconchidae, Cryptoplacidae, Plaxiphoridae,* and *Chitonidae.* The fourth and seventh of these are not yet represented in New Zealand waters. A useful key to these families is presented (p. 194), and also to the various genera and species as they are treated.

Besides this exhaustive monograph, numerous other papers on the Loricates have appeared recently. Ashby in his "Monograph on Australian Fossil Polyplacophora (Chitons)" *(Proc. Roy. Soc. Vict.,* vol. 37, N.S., pp. 170-205, 1925), and in his "Acanthoid Chitons of New Zealand" *(Proc. Mal. Soc.,* vol. 17, pp. 5-35, 1926) has proposed several changes in classification, and in the value and nomination of the higher groups, while in his "Regional Distribution of Australian Chitons (Polyplacophora)" *(Rep. Austr. Assoc. Adv. Sci.,* vol. 17, pp. 366-393) he suggests alteration of Hedley's Australian regional divisions and proposes the new names Indo-Australian and Tasmanian, suppressing Solanderian in favour of Dampierian (which he constantly misspells Damperian). It is unfortunate that these papers are marred by lack of lucidity and method, and the conclusions often obscurely worded; they frequently clash with those of Iredale and Hull, but in every case the opinions of the latter authors seem to merit more consideration than he has given. His regional divisions are not adopted here; further evidence as to their validity seems to be required.

Odhner (1924, pp. 5-9) has recorded a considerable number of species from many localities visited by the Mortensen Expedition, but the identifications do not always seem to be trustworthy. Finally, Miss Mestayer has contributed a couple of papers *(Trans. N.Z. Inst.,* vol. 53, pp. 176-179, 1921; *l.c.,* vol. 56, pp. 583-587) in which several new species are described. Two of her species *(Acanthochiton foveauxensis* and *Macandrellus oliveri)* have been anticipated by Ashby, who, while referring to her MS. account, has described and figured them in his paper (1926B, pp. 20, 18) as *Notoplax (Amblyplax) foveauxensis* and *Notoplax (Amblyplax) oliveri* respectively; his account and names have one month's priority.

Lepidopleurus inquinatus (Reeve, 1847). [P. 6]

This is the species for which Ashby proposed *(Proc. Roy. Soc. Vict.,* vol. 33, N.S., p. 157, 1920) the new name *L. iredalei* through a mistaken idea; he has since rectified his error *(Trans. Roy. Soc.*

*Ashby has recently (*Rep. Austr. Assoc. Adv. Sci.,* vol. 17, p. 379, 1926) in an "Explanatory Note" rejected this name, but his reasons are inadequate, and the note not explanatory.

S.A., vol. 47, p. 217, 1923). Attention is here drawn to this as Finlay (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 342, 1923), Oliver (1923A, p. 529), and Odhner (1924, p. 5) have used Ashby's incorrect name.

The genus *Terenochiton* Iredale, 1914 (*Proc. Mal. Soc.*, vol. 11, p.28) may be used for this species, and there are several others to be described in Neozelanic waters. Odhner (1924, p. 5), in identifying and figuring a valve from Campbell Island as *inquinatus*, has noted that it differs from Stewart Island specimens, also figured. Hedley (1916, p. 34) has added from Macquarie Island *Lepidopleurus kerguelenensis* Haddon, but this seems a doubtful identification from every point of view.

Genus **Callochiton** Gray, 1847. [P. 12]

Iredale and Hull (*Austr. Zool.*, vol. 3, pt. 8, p. 349, 1925) have noted that *Callochiton* auct. is not *Callochiton* Gray, 1847, of which the type is *Chiton laevis* Pennant. They have accordingly proposed the genus name *Levicoplax* for *Chiton platessa* Gould, and classed the Australian members of the Lepidochitonidae under this genus, *Icoplax* Thiele (for *Chiton puniceus* Couthouy), and *Eudoxoplax* Iredale and May (for *Chiton inornatus* T.-W.). The last named is not represented in New Zealand, but *Levicoplax* will include *platessa* (Gould) (I have recorded the finding of two specimens of this species at Taieri Beach: *Trans. N.Z. Inst.*, vol. 55, p. 517, 1924) and *Callochiton mortenseni* Odhner (1924, p. 6), from Campbell Island. *Icoplax* will cover the remaining New Zealand species, regarding which quite a number of notes have appeared, as follows:—

I. empleurus (Hutton). Miss Mestayer (*Trans. N.Z. Inst.*, vol. 53, p. 180, 1921) has supplemented Suter's description of the valves and has lately figured and given Oliver's description of the radula (*l.c.*, vol. 56, p. 583, 1926). I have recorded the species from the littoral in Dunedin Harbour (*l.c.*, vol. 55, p. 517, 1924), and Odhner records it from Campbell Island (1924, p. 6), though as he mentions differences in sculpture and slitting, he probably had a distinct species.

I. sulculatus (Suter). Recorded by Odhner (1924, p. 7) from North Channel, Kawau Island (misspelt "Kawaii").

I. kapitiensis (Mestayer) (*Trans. N.Z. Inst.*, vol. 56, p. 583, 1926). Described from Kapiti Island on the specimens Suter identified as *Chiton limans* Sykes.

Family **Plaxiphoridae** Iredale.

Add *Plaxiphora (Maorichiton) lyallensis* Mestayer (*Trans. N.Z. Inst.*, vol. 3, p. 176, 1921). Notes have also been given by Miss Mestayer on *P. zigzac* (Hutton) (*l.c.*, vol. 56, p. 584, 1926) and *P. ovata* (Hutton) (*l.c.*, p. 585), which she treats as distinct from *Fremblya egregia* H.Ad. Powell (*N.Z. Journ. Sci. & Tech.*, vol. 6, p. 285, 1924) has recorded *P. biramosa* (Q. & G.) from the Cookian Region.

Hemiarthrum setulosum Dall, 1876.

This extraordinary genus and species is added to the Neozelanic list by Hedley, as common at Macquarie Island (1916, p. 34); Iredale

has studied the specimens and suggests that *Hemiarthrum* may be a degenerate Plaxiphorid (see also *Austral. Zool.*, vol. 3, pt. 8, p. 339, 1925), "the unslit head plate being faintly striated, the sutural laminae of the median valves being more like those of *Plaxiphora* s.l. than of *Acanthochiton* s.l., while the little unslit projecting tail plate is like that of a young Plaxiphorid, and not at all Acanthochitonoid. Further, the sculpture agrees better with that of the former, and curiously enough, while Carpenter noted only four tufts around the head valve—the correct number for an *Acanthochiton*—Haddon pointed out that the specimen he examined had six, while the specimens in the Australian Museum prove to have *eight,* which pretty definitely determines the relationship.

The Macquarie Island shells appear to be a little different, the sculpture being finer and the mucro of the posterior valve nearly median and little elevated, while in the extra-limital shell the mucro is elevated and terminal." (in litt.)

Plaxiphora aurata (Spalowsky, 1795). [P. 21]

This name was incorporated in the "Commentary" as the correct name for the species Suter called *P. superba* and this conclusion has been accepted by Hedley in his Antarctic Report (1916, p. 35), where unfortunately he has spelt the specific name *"aureus"*; a long synonymy is there given, but Iredale writes me that "still another synonym has to be added with a somewhat humorous history, viz. *Chiton raripilosus* Blainville *(Dict. Sci. Nat.* (Levrault), vol. 36, p.547, 1821). Attention was drawn to the identity of this species by Pelseneer, but was overlooked by Iredale. Subsequently Dupuis *(Bull. Mus. & Hist. Nat. Paris,* p. 535, 1917) recognised the type in the Paris Museum, and ignorant of both Pelseneer's and Iredale's papers proposed it as the valid name for the species. Then Ashby, glancing at the Loricates in the Paris Museum, noted *(Trans. Roy. Soc. South Austr.,* vol. 46, p. 576, 1922) that this species of Blainville's was quite foreign to him, not recognizing in it the type of *Plaxiphora,* a generic name he has recently preferred for Australian shells."

Family **Cryptoconchidae** Iredale.

This is Suter's "Family Acanthochitidae Fischer" [P. 25], and Ashby's "Family Acanthochitonidae Hedley" *(Proc. Mal. Soc.,* vol. 17, p. 10, 1926). Ashby does not accept Iredale's Family name, giving as his reason, "Under the International Rules, the law of priority does not apply to ordinal or family and subfamily names, the word 'type-genus' in Article 4 of those rules meaning 'Typical genus'." He then considers *Acanthochites* Risso as typical of the family, notes that it has been supplanted by *Acanthochiton* Gray (em. by Iredale, 1915, p. 422) and proceeds to derive new family and subfamily names from this source. Now Iredale has, in another connection, stated his views quite clearly as follows: "the family name....should be called Pyrenidae, not Columbellidae....I have been questioned as to my argument, the only rule in this connection reading "The name of a family is formed by adding the ending *-idae*

. . . . to the root of the name of its type genus." The only type genus of a family I can recognise is the oldest genus admitted in the family. The selection of any other would cause as much confusion as there is in recognising the type species of a genus at present, and give rise to even more complications." *(Proc. Mal. Soc.*, vol. 12, p. 33, 1916). If any sort of stability is to be maintained, this is the only logical interpretation that can be given to the rule in question; the point is so manifest that it need not be laboured, and Ashby's contrary action must be rejected.

It has already been noted that two new Recent species of this family described by Miss Mestayer must be credited to Ashby as author. Ashby also sinks Miss Mestayer's *Acanthochiton foveauxensis* var. *kirki (Trans. N.Z. Inst.*, vol. 56, p. 586, 1926) as a synonym of the species itself; the variation is purely individual. A new genus *Lophoplax* has been created by Ashby (type: *L. finlayi* Ashby) (1926B, p. 29) for a curious form from 60 fathoms Otago Heads; also a new subgenus *Amblyplax,* for *Notoplax (Amblyplax) oliveri* Ashby *(l.c.*, p. 18). Several other new species are proposed, and some buried ones resuscitated by Ashby in the paper quoted. The carnivorous proclivities of *Cryptoconchus porosus* Burrow, 1815, have been made the subject of a note by Miss Mestayer *(N.Z. Journ. Sci. & Tech.*, vol. 3, p. 117, 1920).

Genus **Rhyssoplax** Thiele, 1893.

Miss Mestayer has described a new species *(Trans. N.Z. Inst.*, vol. 53, p. 179, 1921) as *R. oliveri;* the unique type, however, appears to be a juvenile and is almost certainly a synonym of *R. aerea* (Reeve), and not related to the Australian *translucens* (H. & H.). This writer has also rejected *R. limans* (Sykes) from the New Zealand fauna, redescribing the specimens Suter so identified as *Callochiton kapitiensis (l.c.*, vol. 56, p. 584, 1926). I have recorded *(l.c.*, vol. 55, p. 518, 1924) *R. canaliculata* (Q. & G.) from the littoral, Dunedin Harbour, an unusual occurrence. The obscure *R. huttoni* Suter has been recorded from several localities by Odhner (1924, p. 9), but the specimens he sent me so named were *Sypharochiton sinclairi* (Gray)!

Genus **Lorica** H. & A. Adams, 1852. [P. 45]

Miss Mestayer has shown *(Trans. N.Z. Inst.*, vol. 53, p. 177, 1921) that *Lorica volvox* (Reeve) has no place in the Neozelanic fauna, and has described our species as *L. haurakiensis;* later *(l.c.*, vol. 56, p. 587, Pl. 101, f. 10, 1926) she has figured its radula. I have recorded the species from a Forsterian locality *(l.c.*, vol. 55, p. 517, 1924). I now propose the new genus *Zelorica* for *Lorica haurakiensis* Mestayer. basing its distinctions chiefly on girdle characters. This was described originally as of " medium width, closely set with smooth convex scales, which vary slightly in size. There are no tufts of bristles; the posterior slit extends the whole width of the girdle." *Lorica* has a girdle covering of " large irregular striated scales and numerous spiculose tufts" (Iredale and Hull; *Austral. Zool.* 3, pt. 8, p. 357, 1925); the anterior valve is also not so prominently recurved. Neither *Loricella* nor *Kopionella* can be utilised, so a new genus becomes necessary.

Onithochiton subantarcticus Suter, 1907. [P. 49]

I have published a note on this form *(Trans. N.Z. Inst.*, vol. 55, p. 521, 1924), but, owing to lack of material, was unable to decide on its status. Since then Odhner has sent me specimens identified as var. *subantarcticus* from Campbell Island, and these are quite distinct from *neglectus,* so that the form should be recognised as a separate species.

Family **Cavoliniidae.** [P. 53]

This spelling is wrong, as the genus name is written *Cavolina.* It is a very doubtful point whether Abildgaard's name has preference over Bruguiere's proposition of *Cavolina* of the same year, but this cannot be settled at present.

Hedley has allowed his *strangulata* specific rank (1918, p. M 106) and this should be here followed, eliminating *longirostris.*

For *Cavolina trispinosa,* Hedley has used *Diacria* generically, a usage to be recommended, and adopted here.

Cavolina uncinata Rang appears to be a doubtful constituent of the New Zealand fauna, as no authentic record is cited by Suter.

Of *Cuvierina columnella* Rang, Suter wrote, "This is the only living species of *Cuvierina,*" but Hedley has preferred *urceolaris* Moerch as a distinct species for the Australian form, and also revived the genus name *Vaginella,* proposed by Daudin generations ago; under this name Clark *(Trans. N.Z. Inst.*, vol. 37, p. 419, 1903) and Marshall *(Trans. N.Z. Inst.*, vol. 50, p. 263, 1918) have described Tertiary species from New Zealand (see list after following note).

Four species of *Clio* have been admitted to the New Zealand Tertiary fauna by Suter *(Alph. List N.Z. Tert. Mollusca,* p. 10, 1918), viz., *annulata* (Tate), *rangiana* (Tate), *tatei* Suter, and *urenuiensis* Suter. The first of these cannot be definitely rejected at present, but probably will be when better specimens are available; the second, however, has already been written off by Marwick *(Rep. Austr. Assoc. Adv. Science,* vol. 16, p. 323, 1924). "*Clio tatei* Suter" seems to be a *nomen nudum,* it was apparently first introduced in 1915 *(Alph. Hand-List N.Z. Tert. Mollusca, p.* 7), perhaps as a new name for one of Tate's species; in the "Lists of New Zealand Tertiary Mollusca" *(N.Z. Geol. Surv. Pal. Bull.* No. 8, p. 50, 1921) there is only one occurrence of the name, in a list of fossils collected by Thomson and Speight at Trelissick Basin, but no legal definition of the species has been given. *Clio urenuiensis* Suter may from the figure be anything at all; specimens have not been seen.

Finally, Miss Mestayer *(Trans. N.Z. Inst.*, vol. 48, p. 124, 1916) has added to the New Zealand fauna *Styliola subula* (Q. & G.) (misspelt *sublata* in her paper), and Hedley (1916, p. 64) has identified some 20 specimens washed up on the shore of Macquarie Island after a gale as *Cliodita caduceus* Q. & G. *(Ann. Sci. Nat.*, vol. 6, pt. 21, p. 74, 1825).

Genus **Limacina.** [P. 57]

Iredale has shown *(Proc. Mal. Soc.*, vol. 11, p. 295, 1915) that this genus name must give way to *Spiratella* Blainville, but probably

Embolus Jeffreys must come into use for the second species added by Miss Mestayer, *Limacina inflata* Orbigny (*Trans. N.Z. Inst.*, vol. 48, p. 124, 1916). Marwick has introduced a new genus *Lornia* (*Trans. N.Z. Inst.*, vol. 56, p. 316, 1926) for *Lornia limata* n. sp., a Waiarekan fossil with the facies of a *Spiratella*, but very much larger; it may not be a Pteropod at all.

A list of the present-known species of Pteropods from New Zealand, with their localities, would appear as follows:—

Cavolina inflexa (Lesueur, 1813)	(off Great Barrier Island)
„ *strangulata* Hedley, 1907	(off Great Barrier Island)
„ *telemus* (Linné, 1758)	(Chatham and North Is.)
Diacria trispinosa (Lesueur, 1821)	(off Great Barrier Island)
Spiratella australis (Eyd. and Soul, 1840)	(Lyall Bay)
Embolus inflatus (d'Orb., 1836)	(off Big King and North Cape)
(?) *Lornia limata* (Marwick, 1925)	(Waiarekan Tuffs, Eocene)
Clio annulata (Tate, 1887) (?)	(Black Point, Eocene)
„ (?) *urenuiensis* Suter, 1917	(White Cliffs, Pliocene)
Cliodita caduceus Q. & G., 1825	(Macquarie Island)
Styliola subula (Q. & G., 1827)	(off Big King Island)
Cymbulia parvidentata Pelseneer, 1888	(Cook Strait)
Vaginella urceolaris (Moerch, 1850)	(off Great Barrier Island)
„ *aucklandica* Clarke, 1903	(Orakei Bay, Pliocene)
„ *torpedo* Marshall, 1918	(Kaipara, Oligocene)

Family ACMAEIDAE [P. 61]

A valuable account of the Recent and fossil New Zealand and Australian members of this family has just appeared from the pen of W. R. B. Oliver (*Trans. N.Z. Inst.*, vol. 56, pp. 547-582, 1926), and no more can be said on the subject here. He states that "The characters of the radula have been used in defining the genera and subgenera," and further that, "Apparently the shell and radula characters do not always run parallel....species whose shells are alike have quite different teeth, while, conversely, the same radula formula is found in species having very unlike shells." (p. 548). This is but further confirmation of what I have already stressed in my introduction (written before Oliver's paper appeared), and it is safe to assume that similar independence of shell and radula characters will be found in almost every molluscan family. Oliver creates the following new groups for Australasian Acmaeas:—

Chizacmea for *Patelloida flammea* Q. & G. (p. 558).
Asteracmea for *Helcioniscus illibrata* Verco (p. 563).
Actinoleuca for *Patella campbelli* Filhol (p. 567).
Conacmea for *Acmaea parviconoidea* Suter (p. 577).
Thalassacmea for *Notoacmea badia* Oliver (p. 579).
Subacmea for *Notoacmea scopulina* Oliver (p. 580).

the last three being treated as subgenera of *Notoacmea* Iredale. He also notes two changes in specific names of New Zealand species,

both introduced by Iredale: ***Patella inconspicua*** Gray, 1843 ***(Dieff. Travels N.Z.***, vol. 2, p. 244) supercedes ***Fissurella rubiginosa*** Hutton (Iredale, 1924, p. 237), and the specific name ***fragilis*** is restored to the sole species of *Atalacmea, **Patella fragilis*** Sow., 1823 *(Gen. Shells*, pt. 21, pl. 140, f. 6, and text) antedating *P. unguis-almae* Lesson, 1830 (Iredale, 1924, p. 238). Oliver, however, retains *rubiginosa* Hutt. as a trinomial for the Moriorian form (p. 565), sinking *Acmaea cingulata* Hutton instead as an absolute synonym of *inconspicua* Gray.

Radiacmea macquariensis Hedley (1916, p. 41) and several new species and subspecies are added to the New Zealand "*Acmaea*" fauna in Oliver's monograph.

Genus **Nacella** Schumacher, 1817. [P. 76]

Suter admitted this genus and under the section *Patinigera* Dall ranged two species, *Nacella fuegiensis* (Reeve, 1855) and *Nacella illuminata* (Gould, 1846). The distribution of the former was given as Campbell Island and Macquarie Island, and of the latter as Antipodes Island, Auckland Islands, Campbell Island, and Macquarie Island. Under the genus *Helcioniscus* appeared *H. redimiculum* (Reeve, 1854) from the mainland, Chatham, Bounty, and Auckland Islands; and *H. strigilis* (Hombron and Jaquinot, 1841) from the mainland, Chatham, Antipodes, Auckland, Campbell, and Snares Islands. Iredale in his "Commentary" (p. 432) from study of mainland shells in Otago advised the lumping of the last two, since shells showing variation covering the two accepted types had been collected on the mainland, and the range was small.

A reconsideration of the facts has become necessary since Hedley published his account of the Mawson Expedition Mollusca. Therein he admitted two species only from Macquarie Island, referring both to *Nacella* and giving a good account of the animals and shells. Using *Nacella delesserti* (Philippi, 1849), given to a Marion Island shell, he synonymised Reeve's *redimiculum*, but doubtfully added Hombron and Jaquinot's *strigilis*. He concluded, however, that *Nacella illuminata* (Gould) from the Auckland Islands was a different species. The growth stages he figured of his "*delesserti*" agreed with the forms from the Auckland Islands described as *illuminata* by Gould and as *strigilis* by Hombron and Jaquinot. However, study of growth stages of ***redimiculum*** from the mainland reveals that, although it shows parallel stages to ***illuminata*** and ***strigilis***, the juvenile is more coarsely ribbed and secondary sculpture is obsolete, in this respect showing an approach to the Tasmanian shell known as *limbata* and commonly referred to ***Cellana***. This suggests study of the Tasmanian species, and also of the mainland New Zealand ***redimiculum***, which is superficially a true "Nacelloid." Since ***redimiculum*** is separable, the reference to ***delesserti*** does not seem satisfactory, so that I propose to follow Hedley's first idea and introduce the new name ***Nacella macquariensis*** for the species so well described and figured by him ***(Rep. Austr. Antarct. Exped.***, vol. 4, pt. 1, "Mollusca," p. 42, pl. 6, figs. 65-69), the type series being in the Australian Museum.

We have then a series of subantarctic and mainland forms,—

Nacella macquariensis nov.		Macquarie Island
„ *strigilis* (H. & J., 1841) =*illuminata* (Gould, 1846)		Auckland Island
„ *terroris* (Filhol, 1880)		Campbell Island
„ *redimiculum* (Reeve, 1854)		South Island

Before one can determine any further synonymy or localities, specimens must be examined, as *N. illuminata* has been recorded from Antipodes Island, *H. redimiculum* from Chatham, Bounty, and Auckland Islands, and *H. strigilis* from the whole of the mainland and all these places except Macquarie Island, while Hedley's adult shell from that locality would have been so named without question. Suter's *strigilis* from Tauranga is the most interesting record. For the kelp living form Hedley has preferred *Nacella kerguelenensis* Smith, proposed for a Kerguelen species, to *N. fuegiensis* Reeve used by Suter, observing that the Macquarie Island forms "agree generally with specimens from Kerguelen Island." In this case also it would have been better to have proposed a new name for the form under consideration.

Helcioniscus radians (Gmelin, 1791). [P. 81]

In the *N.Z. Journal of Science and Technology* (vol. 2, Nos. 4 and 5, p. 264, 1919), Dr. Allan Thomson has provided some interim notes on "Polymorphism in the Common New Zealand Limpet, *Cellana radians* (Gmelin)," and his full conclusions have not yet appeared. The technical names, owing to their extremely involved nature, need careful consideration, but may really be left till the facts are established. However, it is as well to note that *Patella decora* Philippi undoubtedly refers to this group, and not to the *strigilis* series; Thomson (*l.c.*, p. 264) accepted Suter's recognition of a photograph of the original illustration, but the accompanying description giving details which apply to *radians*, not *strigilis*, was not considered by either Thomson or Suter. Thomson has written, "The high conical shells go through a depressed stage with an anterior apex. They are therefore more advanced in form than the depressed adult shells, and deserve specific recognition on this account. The species *perana* and *flava* belong here. Perhaps an intermediate species should be recognised. The type of *radians* is a depressed form." Most workers, however, will not agree that in the limpets form alone is of specific value. Intensive study of Australian limpets by Iredale has shown that, in confirmation of his former surmise, the shells do vary in this respect (as in others) according to the nature of the rock. To cite a concrete instance, on Long Reef, composed of the Narrabeen Shale, a long depressed shell is found, and on the sandstone boulders adjacent thereto a higher shell occurs, while in Freshwater Cove, three or four miles south, a much higher, more conical form lives on the sandstone. Series can be easily collected which would be valid species according to Thomson's dictum, but which we know are not recognisable variants. According to the exact position with regard to wave stress, variation in shape occurs and is not governed by locality. Thus at the Bottle and Glass Rocks

inside Sydney Harbour, on sandstone exposed to surf, the shells agree fairly closely with those from the Narrabeen Shale of Long Reef, save in colouring, which is much richer.

Cellana stellifera (Gmelin, 1791). [P. 86]

Noted by Powell (*N.Z. Journ. Sci. & Tech.*, vol. 4, p. 204, 1921) as plentiful at Busby Head, Whangarei Heads. Suter gives this species a range from Cape Maria van Diemen to Campbell Island; this needs investigation. Bucknill (1924, pl. 2, figs. 10, a, b) has lately figured young and old examples. He has also figured (*l.c.*, figs. 8, 9) *Cellana ornata* (Dill.) and the subspecies *inconspicua* (Gray) admitted by Suter [P. 81]. But it has already been noted (see Note on Family Acmaeidae) that *Patella inconspicua* Gray applies to the common mainland *Radiacmea*, and not to a limpet, so that the *ornata* variety is at present nameless. Iredale (1924, p. 238) doubts whether the form is worth distinguishing, and from what I have seen I am inclined to agree, but the matter must be left till someone can study large suites from many localities.

Scissurella mantelli Woodward, 1859. [P. 88]

This species belongs to the genus *Schizotrochus*, a world-wide group of but few species. When Miss Mestayer described a fine shell as *Scissurella regia* nov. (*Trans. N.Z. Inst.*, vol. 48, p. 123, 1916), she noted that Hedley had suggested the possibility of her having found the long lost *mantelli*, and then said, "but it does not at all resemble that species, being more depressed, and quite differently sculptured." In these comparisons she was evidently judging from Suter's figure in the Manual "Atlas," which is almost the extremity of crudeness. Pilsbry (*Man. Conch.*, vol. 12, Pl. 57, f. 12) gives a much better copy of Woodward's figure, which portrays a shell very like that depicted by Miss Mestayer, allowing for different aspects of view and methods of illustration. When one remembers the paucity of species of *Schizotrochus* (only one species being usually present in a faunal area, and that species having generally a wide range), and the fact that both these forms were described from the North Island, it is not difficult to imagine that they represent the same thing, and from examination of paratypes in my possession I can affirm that this is so. *Schizotrochus mantelli* (Woodward) therefore becomes the name for the only Recent Neozelanic member of this genus, *regia* Mestayer falling as a synonym; I have seen fossil ancestral species. As regards other Scissurellas, Iredale has proposed the new genus *Scissurona* for the *rosea* type (1924, p. 215), and no true *Scissurella* has yet been described from New Zealand, though undescribed species are known to me.

Genus **Schismope** Jeffreys, 1856. [P. 89]

Suter admits three species and a subspecies, two of the species being identified with Australian shells. Both these records must be expunged, for reasons given below, where the Neozelanic species are described as new. Suter's figures are not drawn from New Zealand shells; that of *S. beddomei* is a poor tracing of May's drawing ("Revised Census of the Marine Mollusca of Tasmania," Pl. 24, fig.

24, 1901), while that of *S. atkinsoni* seems to be a careless copy of Watson's figure of his *S. carinata* (Chall. Rep., vol. 15, p. 119, pl. 8, fig. 6, 1886). There are at least two species of the *beddomei* group found in deep water off the Snares, but neither of these matches with Australian forms; there are other species of the same group from more northern localities.

Schismope lyallensis n. sp.

Shell generally similar to *S. atkinsoni,* but with less prominent keels. Sculpture above fasciole very inconspicuous, only some raised growth-lines and a few spiral grooves; below the sunken fasciole with its raised edges there is a broad concave almost smooth space, then another keel emerging from the suture; below this, base is lightly convex, and is scored by 8-9 shallow grooves, marking very low broad ribs, inner ones of which are in and on margin of umbilicus, which is wide and deep, defined by a blunt keel; above inner spiral rib there are numerous curved axial threads. Base nowhere angled by any of the ribs (there is a third keel in *atkinsoni);* whorls bulge out further past fasciole than in Tenison-Woods' species, and aperture is less oblique, due to narrower umbilicus. Whole of aperture bounded by curved lines, not straight as in *atkinsoni.* Anal perforation one-eighth of a whorl in length.

Height, 1.5 mm.; diameter, 1.8 mm.

Locality,—Lyall Bay, in shell sand.

Schismope laqueus n. sp. (Figs. 30, 31.)

Closely allied to *S. beddomei,* but differing, as Suter says, in larger size and more depressed shape, also in more numerous axial ribs. Spire hardly at all elevated, the smooth shoulder being very broad and horizontal, apex lightly concave. Constantly about 15 axial ribs (interstices about twice their width) on base below the smooth concave space under fasciole keel, and about the same number before the aperture on upper side, diminishing regularly in size, but remaining conspicuous till almost hidden by sinking of the upper whorls. Ribs on spire begin to encroach on shoulder about 1¼ whorls from aperture. About four narrow and distant spiral threads distributed over base. Umbilicus moderately large and deep. Other details as in *S. beddomei.*

Height, 1.25 mm.; diameter, 1.5 mm.

Locality,—Snares Island, in 50 fathoms.

Schismope iota n. sp.

More like *beddomei* in size, but less elate and with fewer axial ribs, and different aperture. Spire projecting, its sides formed by the rather high penultimate whorl, its lightly convex top by the much depressed earlier whorls; the smooth shoulder is not so wide as in previous species, and distinctly sloping. Constantly 9 narrow and distant axial ribs (interstices 3-4 times their width) on base, and about same number of prominent and still distant ribs before aperture on upper whorls, followed near apex by about half-a-dozen smaller and closer ribs. Ribs on spire encroach on shoulder when less than a whorl from aperture. About three almost obsolete spiral ribs very close together bordering umbilicus, which is narrow and very shallow.

Aperture suboval except for straight columellar edge, only slightly angled above, margins much thickened for so small a shell. Anal perforation smaller and with much less raised margins than in *beddomei* and *laqueus*.

Height, 0.9 mm.; diameter, 0.8 mm.

Locality,—Snares Island, in 50 fathoms.

Sinezona n. gen.

I propose this name for the *Schismope brevis* group, naming that species as type. The distribution of species in this group invites consideration, Hedley's *brevis* being recorded from Lyall Bay (type), Snares Island, in 50 fathoms, and Lyttelton Harbour; while the subspecies *laevigata* Iredale is given as from Sandfly Bay (type) and Lyall Bay. Examination of numerous specimens shows that there is but one species of *Sinezona* at Lyall Bay, differing from all the southern forms in its more central apex and inflated spire-whorls. *Laevigata* Iredale should be regarded as a distinct form, characterized by low and generally quite smooth spire, lateral elongation of the last whorl, less tumid whorls (noticeable especially on the base), and short fasciole. I have recorded it from Taieri Beach *(Trans. N.Z. Inst.*, vol. 55, p. 517, 1924), and it seems to be typically a Forsterian form, but Snares specimens are not at present separable; *brevis,* of course, does not occur at the Snares. Finally, *Schismope subantarctica* Hedley *(Rep. Austr. Antarct. Exped.*, vol 4, pt. 1, p. 36, pl. 5, figs. 54, 55, 1916), from Macquarie Island, must be added to the Neozelanic list of *Sinezona.* Miss Mestayer *(Trans. N.Z. Inst.*, vol. 51, p. 130, 1919) has recorded this species from Lyall Bay and the Snares, but these records may be rejected without much hesitation; *subantarctica* is easily distinguished from the Lyall Bay *brevis,* while it differs from *laevigata* in being smoother, less elongate laterally, the last whorl rapidly descending downwards, and in having—in the unique type—no fasciole behind the perforation. The nearest approach to *subantarctica* I have seen is an undescribed species from the Chatham Islands. The absence of the fasciole-girdle suggests the name chosen for the genus and will afford a ready means of recognition; the whole facies, however, is peculiar. *S. lacuniformis* Watson *(Chall. Rep.*, vol. 15, p. 118, pl. 8, fig. 8), from off the West Indies is superficially like this group, but has a gaping umbilicus; in *Sinezona* this is generally sealed up by the inner lip.

Genus **Haliotis** Linnaeus, 1758. [P. 92]

In the *Proc. Mal. Soc. (Lond.),* vol. 9, p. 260, 1911, Iredale pointed out that Montfort had selected as type of *Haliotis* the Linnean species *asininus,* and had introduced *Padollus* for a species *rubicundus.* If we admit that more than one genus is represented in the Linnean *Haliotis,* and if Montfort's action were upheld, the New Zealand shells would all fall into his *Padollus.* Iredale informs me, however, that reconsideration suggests that as *tuberculata L.* was the well-known species, and commonly regarded as such, being named *vulgata* and *vulgaris, Haliotis* may be retained in connection with it; a most desirable proceeding. The New Zealand species may thus, for the present, all be left in *Haliotis.*

Haliotis australis Gmelin, 1791. [P. 93]

Add to the synonymy *Haliotis aleata* Bolten (*Mus. Bolten,* p. 14, 1798). In the synonymy Suter has included *Haliotis plicata* Karsten (*Mus. Leskeanum,* p. 297, 1789), which would have priority, but Karsten's names are unacceptable as they are simply quotations from binomial and also non-binomial authors, without any attempt to treat them all binomially.

Haliotis varia Linnaeus, 1758. [P. 94]

This should be placed on a suspense list in the meantime. No authentic specimens are known to local collectors, and the New Zealand habitat of the specimens Suter recorded is open to doubt.

Haliotis huttoni Filhol, 1880. [P. 96]

This form also occurs at Auckland Island, and may be trinomially treated as a regional development of *virginea* Gmelin. Odhner's record of *virginea* from Auckland Island (1924, p. 12) refers to this form; the differential characters given by Suter are quite good.

Fissurella huttoni Suter, 1906. [P. 97]

From study of the type specimen in the Dominion Museum, Oliver has formed the opinion (private communication), which he has kindly allowed me to publish, that it is an exotic shell, probably *Diodora barbadensis* (Gmelin), and should share the fate of *Raeta perspicua* Hutton and other extra-limital species wrongly included in the New Zealand fauna by Hutton. Hutton originally gave no locality for his *Fissurella squamosa,* "Foveaux Strait" being added later; it may be noted that Oliver has written (*Proc. Mal. Soc.,* vol. 15, pt. 4, p. 186), "In his Manual, Hutton appears to have set himself the task of attaching localities to the species he had previously included in his Catalogue without any." The matter is, however, complicated by the fact that there are in the British Museum (*fide* Iredale) specimens, reputedly Neozelanic, referred to this species. These seem to be related to the Australian shell long known as *lineata* Sow., but which Iredale (1924, p. 220) has named *Elegidion audax.* The collecting and dredging of many years in New Zealand by both local and outside workers has failed to bring to light any further specimens, so that one may query the British Museum record, and the best course appears to be the relegation of this species in the meanwhile to the suspense list, with the probability that it will not be found to live in New Zealand.

Genus **Emarginula** Lamark, 1801. [P. 99]

Chapman and Gabriel have written (*Proc. Roy. Soc. Vict.,* vol. 36, N.S., p. 29, Dec., 1923) of *Emarginula wannonensis* Harris that "Suter (*Alph. Hand List N.Z. Tert. Moll.,* p. 9, 1915) has also given it as a living species in New Zealand, but so far we have not met with any occurrence recorded from that or any other area." The authors then proceed to comment on the long range possessed by this and other species, several times citing *wannonensis* as a Tertiary form now found living only in New Zealand. If, however, they had

thought to check their statement by reference to the later *Alph. List Tert. Moll.*, p. 13, 1918, or to any of the *Palaeontological Bulletins*, e.g. No. 9, appearing after 1915, they would not have made this error. Suter had no intention of recording Harris's species as a Recent New Zealand shell; the asterisk in the 1915 List is very evidently a typographical error; it is known that that list contains many such mistakes, and seems to have been compiled in haste. The Tertiary records of *E. wannonensis* are mostly based on specimens from the Kakanui and Waiarekan tuff horizon; they must be rejected also; the form in question is a new species of the *striatula* group, and there do not seem to be in New Zealand any members of the *wannonensis* type. Of the Australian Tertiary species discussed by Chapman and Gabriel, only *dennanti* and *delicatissima* seem to have affinity with Neozelanic forms.

Fissuridea monilifera (Hutton, 1873) [P. 105]

This species has nothing whatever to do with *Fissuridea*, which has the "animal capable of being contained entirely within the shell", to quote Suter's own definition, whereas the New Zealand animal is much too large for its shell. As a matter of fact it is closely related to the Australian shells such as *javanicensis* Lamarck, *nigrita* Sow., and *concatenata* Crosse and Fischer, each of which has proved, from examination of the radula and animal, to represent a distinct genus. Iredale (1924, pps. 182, 218, 219) has generically named these as *Amblychilepas* Pilsbry, *Sophismalepas* nov., and *Cosmetalepas* nov., and as the New Zealand shell has a different type of sculpture, and the genera are very local it would be wiser with our present knowledge not to attach the Neozelanic species to any one of these, but to propose the new generic name, *Monodilepas* for it alone. It may be noted here, however, that at least three species of *Monodilepas* inhabit the New Zealand area, one of which is known at present only from the Moriorian Province; there is also an undescribed older Tertiary species from the Clifden beds (Finlay, *Trans. N.Z. Inst.*, vol. 55, pp. 534-38, 1924), so that the lineage is evidently an ancient one.

Montfortula conoidea (Reeve, 1842). [P. 101]

Simultaneously with Iredale's report in the "Commentary," Hedley published some notes on this group (*Proc. Linn. Soc. N.S.W.*, vol. 39, p. 706, 1914 (Feb. 26, 1915)), and followed this up with a review of the genera *Tugalia* and *Scutus* (*Proc. Linn. Soc. N.S.W.*, vol. 41, pp. 695, 704, 1916 (Apl. 4, 1917)). In the "Commentary" Iredale suggested that, if association of the "*rugosa*" group were necessary, it should be with *Emarginula*, not with *Hemitoma* where it had been placed. Further study shows the *Montfortula* series to constitute a distinct development, the Sydney species, for which Iredale has revived Reeve's name as above, living and growing to a large size at high water mark, a station quite different from that occupied by the other groups, which live below low water. The New Zealand shell, misrecognized as *rugosa*, appears to be both rare and nameless. Only one authentic specimen from the mainland is at present known to local collectors; it is in Miss Mestayer's collection,

but has not been available for examination, so that unfortunately no details of its affinities can be given. There are, however, in the Finlay collection three specimens of a new *Montfortula* from the Chatham Islands; these differ in shape and sculpture from *conoidea* Reeve, and will be described in the Chatham Report. Also, from examination of the type, kindly lent by Mr. Bartrum, I have determined the lower Pliocene *Tugalia kaawaensis* Bartrum (*Trans. N.Z. Inst.*, vol. 51, p. 100, 1919) as referable to this genus.

Tugali elegans Gray, 1843 [P. 102]

In his account of this genus, Hedley proposed for the shell Suter included as *S. parmophoidea* the new name *Tugalia bascauda* (*Proc. Linn. Soc. N.S.W.*, vol. 41, p. 698, pl. 52, fig. 47, 1916 (Apl. 4, 1917), a praiseworthy innovation, but he allowed Reeve's specific name *intermedia* for the second New Zealand species. Iredale (1915, p. 435) had indicated his distrust of the name, and it should be rejected in favour of the correct name above given almost simultaneously by Gray. Reeve's name was given to a Philippine Island species in the first place; the type was apparently lost, Sowerby synonymised it with *cinerea* Gould—a later name—, and Reeve finally accepted the synonymy and gave a figure of a specimen in Sowerby's collection. It is obvious that if Reeve rejected his own species, there can be no reason for considering it in connection with the Neozelanic fauna, when there is an exact name of even date available. Iredale (1915, p. 432) has already noted that the generic name was originally introduced as *Tugali* (Dieff. "Travels," vol. 2, p. 259, 1843) and there seems to be no valid reason for rewriting it.

Thiele has proposed *Emarginula (Tugalia) suteri* nov. for a Chatham Island shell (*Conch. Cab.*, Bd. 2, Abth. 4a, p. 105, Pl. 12, figs. 17, 18, 1916), and this would anticipate Hedley's *bascauda,* but though Hedley recorded his species from the Chathams, he chose as type a shell found "under stones near Wellington." This is fortunate, for the Moriorian form regionally differs from the mainland shell in greater elongation, generally more parallel sides, and squarely, not narrowly, rounded anterior end. No perfectly fresh specimens of *suteri* Thiele have been available; it is probable that these would be still more easily differentiated from fresh *bascauda* Hedley.

Local workers have been puzzled as to the criteria for distinguishing some forms of *elegans* from very similar shells referable to *bascauda,* the general distinctions of smaller size and more netted sculpture in the latter often apparently proving of but little use. This confusion is due to the fact that there are living in the New Zealand area not two but four—possibly five—species of *Tugali,* the name "*intermedia*" auct. covering two distinct forms, *elegans* and *colvillensis* n. sp. (q.v.). The only feature which always allows of ready distinction between the *bascauda* and *elegans* groups is the nature of the sinus rib (the median anterior raised cord which overlies the interior groove). In both species this begins as a single strong keel, which in *bascauda* and *suteri* soon bifurcates and remains so to the margin, while in *elegans* and *colvillensis* the sinus rib on breaking up at once becomes triple, often several more riblets being

intercalated before the margin is reached. *Colvillensis* simulates the *bascauda* group in having netted sculpture, and to this is due the confusion of the species, but its true affinities are at once shown by the nature of the sinus rib. I have myself made this error by recording *Tugalia bascauda* from the littoral, Dunedin Harbour (*Trans. N.Z. Inst.*, vol. 55, p. 518, 1924); I now withdraw this, as the trifurcate sinus-rib shows the specimen to belong to the *elegans* group, and though it is juvenile, the altitude, netted sculpture, and carination characterize it as *colvillensis*. *Bascauda* does not seem to enter the Forsterian region, but *elegans* has already been reported from Banks Peninsula by Iredale (*Trans. N.Z. Inst.*, vol. 40, p. 392, 1908) as "Dead shells in shell-sand";—these may have been *colvillensis* also.

Ancestral species to these Tugalis occur in the New Zealand Tertiary. I have described (*Trans. N.Z. Inst.*, vol. 56, p. 227, 1926) *T. pliocenica* and *T. navicula* from the Pliocene and Miocene respectively, the former being directly ancestral to *colvillensis* n. sp., the latter of a rather different type, more like the Tertiary Australian *T.crassireticulata* (Pritchard) (*Proc. Roy. Soc. Vict.*, vol. 8, p. 125, 1896) from Table Cape.

Tugali colvillensis n. sp.

Shell intermediate in size between *elegans* Gray and *bascauda* Hedley, high, laterally compressed and narrowly elongate, tapering slightly in front, where there is a very short truncation due to narrowness of interior groove. Front slope decidedly carinate medially, the central sinus-rib at first single, wide, and strong, but soon breaking into three narrow ribs which continue with sublinear interstices to margin. Sculpture netted, much as in *T. bascauda;* in the type the ribs are fairly wide and flattish, but most of the paratypes have narrow radial and concentric ribs, swollen at intersections, with tiny square pits between.

Height, 8 mm.; length, 21.5 mm.; width, 13 mm.

Locality,—Hauraki Gulf, dredged in 20-25 fathoms, near Cape Colville; also Dowling Bay, Dunedin Harbour, one specimen on the littoral, with *Emarginula.*

The specimens were kindly sent for examination by Mr. A. W. B. Powell of Auckland, and the paratypes are in his collection.

Scutus ambiguus (Chemnitz, 1795). [P. 103]

Suter observed, "E. A. Smith has thoroughly revised the genus in an excellent paper in the *Quart. Journ. Conch.*, vol. 2, p. 250, 1879." It should be noted that this revision had taken place some thirty odd years previously, so that probably some emendations were necessary. In the place referred to in the preceding note, Hedley recorded some corrections in connection with Australian forms, and indicated *breviculus* Blainville (*Bull. Sci. Soc. Phil.*, p. 28, 1817) as the name for the Neozelanic species.

Puncturella demissa Hedley, 1904. [P. 104]

Iredale has named this species as genotype of his *Vacerra* (1924, pp. 182, 221), which was provided "for the small austral forms ascribed to *Puncturella,* but which do not closely agree, even in superficial features with the type of that genus."

One may emphasize Iredale's former remark that "summaries are most helpful," and I would express my arrangement of the authentic Neozelanic Rhipidoglossate forms so far dealt with as follows,—

Genus SCHIZOTROCHUS Monterosato 1884 Type: *S. crispata* Fleming.
Schizotrochus mantelli (Woodward, 1859).
Genus SCISSURONA Iredale, 1924. Type: *S. rosea* Hedley.
Scissurona rosea (Hedley, 1904).
Genus SCHISMOPE Jeffreys, 1856. Type: *S. cingulata* Costa.
Schismope lyallensis nov.
—— *laqueus* nov.
—— *iota* nov.
Genus SINEZONA nov. Type: *S. brevis* Hedley.
Sinezona brevis (Hedley, 1904).
—— *laevigata* (Iredale, 1908).
——*subantarctica* (Hedley, 1916).
Genus HALIOTIS Linnaeus, 1758. Type: *H. tuberculata* L.
Haliotis australis Gmelin, 1791.
—— *iris* Martyn, 1784.
—— *virginea* Gmelin, 1791.
—— —— *huttoni* Filhol, 1880.
Genus MONODILEPAS nov. Type: *L. monilifera* Hutton.
Monodilepas monilifera (Hutton, 1873).
Genus INCISURA Hedley, 1904. Type: *S. lytteltonensis* Smith.
Incisura lytteltonensis (Smith, 1894).
Genus EMARGINULA Lamarck, 1801. Type: *P. fissura* L.
Emarginula striatula Q. & G., 1834.
Genus MONTFORTULA Iredale, 1915. Type: *E. rugosa* Q. & G.
Montfortula sp. nov.
[—— *kaawaensis*]* (Bartrum, 1919).
Genus TUGALI Gray, 1843. Type: *T. elegans* Gray.
Tugali elegans Gray, 1843.
—— *colvillensis* nov.
—— *suteri* Thiele, 1916.
—— —— *bascauda* Hedley, 1917.
[—— *pliocenica*] Finlay, 1926.
[—— *navicula*] Finlay, 1926.
Genus SCUTUS Montfort, 1810. Type: *S. antipodes* Montfort.
Scutus breviculus (Blainville, 1817).
Genus VACERRA Iredale, 1924. Type: *P. demissa* Hedley.
Vacerra demissa (Hedley, 1904).

Family **Trochidae.** [P. 105]

Much advance has been made in this group since Iredale's "Commentary" was issued. In connection with Australasian species Iredale has examined many radulae in the Gwatkin collection (now in the British Museum), including some results in his "Roy Bell" essay on Australian forms. Thiele has published a revision of the Trochids based solely on radular characters, but when these were

*In this and similar summaries the enclosure of a name in square brackets indicates that it is a fossil species and does not occur in the Recent fauna.

unknown he has fallen back on shell features. As this Revision will not be seen by many Neozelanic students and is a very important account, a digest (which I owe to the kindness of Mr. Tom Iredale) is here offered. Some startling associations are propounded, but when we realize that we are dealing with one of the most primitive groups of simply-coiled shells, our surprise at these is lessened.

Thiele admits three families: *Trochidae, Cyclostrematidae,* and *Turbinidae,* in his *Stirps Trochacea,* but his Subfamilies are better treated as Families, and his subgenera raised to genera, and thereby one can produce an arrangement more in accord with the lessons learned from palaeontology, which Thiele has ignored. Further, it becomes apparent that the southern Trochoids have developed very long ago, as we find in early Tertiary beds forms practically inseparable conchologically from their Recent descendants. As the separative characters are based almost entirely on animal characters, it is necessary to establish the Recent fauna first, and then associate the fossils with the living species in direct lineage, and with the strictest scrutiny, growth-stages providing the best guide.

Thiele's "Family *Trochidae*" embraces the subfamilies *Margaritinae, Calliostomatinae, Trochinae, Umboniinae, Stomatiinae, Angariinae,* and *Delphinoideinae* (=*Skeneinae,* corrected in MS. in the copy seen). The "Family *Cyclostrematidae*" is used as a receptacle for a few minutiae, and seems a poor proposition. The "Family *Turbinidae*" is subdivided into four subfamilies, *Liotinae, Bothropomatinae, Turbininae,* and *Phasianellinae.*

In the subfamily *Margaritinae* Thiele has associated northern and southern groups, somewhat incongruously if one may judge from shell characters. However, one can avoid argument, as the oldest genus name included is *Stomatella,* so that we can use the Family *Stomatellidae* for our southern mollusca, whether the northern ones are separated or not. Thiele has arranged *Margarella* as a subgenus of the northern *Margarites,* but here again, by accepting a higher value, and admitting *Margarella* as a distinct genus, one can obviate any discussion. *Photinula* is widely separated, being included in the subfamily *Calliostomatinae.* Following the *Margarites* series, Thiele places *Turcica* and its allies, *Calliotropis* (=*Solariellopsis* Schepman, not Gregorio), *Turcicula,* and *Lischkeia.* Conchologically these forms show no great disagreement among themselves, but have no likeness to the preceding *Margarites* shells. They are followed by *Perrinia, Danilia, Euchelus,* and *Stomatella,* another good conchological arrangement, but the next form, *Solariella,* disagrees in every way in shell features, and its palaeontological age denies it very close relationship. Concluding this subfamily are the deep water genera *Basilissa, Seguenzia,* and *Gutterula.*

The subfamily *Calliostomatinae* is utilized for the genera *Calliostoma* and *Photinula* alone, including *Astele* as a subgenus, apparently for the Australian type and some quite unrelated American shells. The radular characters of the southern "Calliostomas" were probably unavailable to Thiele, as they show valid distinctions, and would have been utilized for separation. The reference of *Photinula* here does not seem in accord with the conchological features and southern range.

The subfamily *Trochinae* includes all the usual Trochoids with a few innovations and a few conservative groupings. Thus a "genus" *Gibbula* is admitted, covering "Sectiones (ad libitum)" ranging all over the world, and clutching the austral groups, *Eurytrochus, Calliotrochus,* and *Cantharidella,* but the group name would be *Phorcus* if Thiele's own association were accepted. A genus *Fossarina* is ranged next, with a section *Clydonochilus* and a subgenus *Synaptacochlea.* These three appear to be closely related, though the last named was introduced as a relative of *Gena.* Then follows a genus *Cantharidus,* with a section *Phasianotrochus,* subgenus *Jujubinus,* subgenus *Bankivia* with section *Leiopyrga,* subgenus *Thalotia* with sections *Alcyna* and *Odontotrochus.* The inclusion of *Jujubinus,* hitherto regarded as a subgenus (or genus) of *Calliostoma,* is noteworthy, but obviously it is a valid genus. *Leiopyrga* is also of generic value, while *Alcyna* is a very distinct genus, not closely related to this series at all. The importance of the reference here of *Jujubinus* is seen in the matter of the Australian "Calliostomas," as these appeared to be closely related to *Thalotia,* and this can now be accepted. The only unfortunate item in Thiele's Revision is his worldwide range for relationships, seen again in the next genus, *Monodonta.* This is made to include the European *Osilinus,* as well as the American *Diloma* and *Oxystele. Austrocochlea* (for *constricta*) is ranked as a subgenus of *Mondonta* s.str., while *Melagraphia* (for *aethiops*) and *Chlorodiloma* (for *crinita*) are ranged as sections of the subgenus *Diloma* (for the South American *nigerrima*). Then follow the genera *Chrysostoma, Tegula, Cittarium,* and *Norrisia,* which do not concern us at present. *Gaza* is doubtfully interpolated before *Clanculus,* which is followed by *Trochus* with many sections and one subgenus, *Tectus,* with two sections, *Cardinalia* and *Rochia.*

The subfamily *Umboniinae* comprises a novel series, beginning with *Callumbonella* questionably referred here, then followed by a new genus *Nanula,* proposed for the Australian *Margarita tasmanica* Petterd, *Halistylus,* and then *Minolia,* with sections *Isanda, Umbonella,* and *Conotrochus; Monilea,* with section *Rossiteria* and subgenus *Priotrochus;* and *Ethalia* with a subgenus *Ethaliella,* concluding with *Umbonium.* This will be discussed further on.

The subfamily *Stomatiinae* begins with a doubtful form, *Stylobates,* then the genus *Stomatia* with sections *Microtis, Pseudostomatella* Thiele (for *papyracea* Chemnitz), and *Niphonia;* genus *Phaneta* questionably allied, and *Gena* with a section *Plocamotis;* concluding with genera *Roya* and *Broderipia.*

The subfamily *Angariinae* covers the genus *Angaria* alone; as a section *Angarina* being admitted, though its reference to the family has been disputed.

The last subfamily, *Delphinoideinae* (that is, *Skeneinae*), is a heterogeneous assemblage of minute forms, northern and southern forms being incongruously associated with numerous question marks, and is of little use. Thus, to the genus *Skenea,* a British form of definite status, is added as a subgenus with a "?" Adams' *Tubiola,* a well marked tropical group, the animal of which is unknown. The genus *Daronia* follows, also queried, and as a subgenus, again queried, is added *Cyclostremella,* a northern group quite unrelated. The

genera *Ganesa* and *Tharsiella* succeed, with, as sections, several probably allied groups, but the next series which concerns us consists of austral and Pacific forms, most of them queried. These are *Cirsonella, Lodderia, Teinostoma* (with sections *Pseudorotella, Calceolina,* and *Callomphala*), *Philorene, Leucorynchia, Haplocochlias, Morchiella* Thiele (for *Morchia* A. Adams, 1860, not Albers, 1850), and *Microtheca. Haplocochlias* is geographically dissevered, the remainder agree in geographical distribution. Thiele's blunder in proposing *Morchiella* is notable, as that is the genus name of a well known group of Rissoinids, and *Morchia* A. Adams is valid since Alber's name was not proposed until later on in the year 1860.

The Family *Cyclostrematidae* is a curious selection, as Iredale has shown that Marryat's *Cyclostrema* is indeterminable, but very probably a Liotinid. Attached hereto are *Vetulonia, Circulus, Zalipais, Brookula* with section *Liotella, Chunula, Cithna,* and *Lissotesta,* the last two and the first queried.

The Family *Turbinidae* begins with a subfamily *Liotiinae,* based on *Liotia,* which Thiele uses for the forms Iredale referred to *Liotina,* the other genera included being *Môlleria* and *Leptothyra,* a few sections and subgenera being admitted. The subfamily *Bothropomatinae* is proposed for a new genus and species, *Bothropoma isseli*: this is an interesting form from the Red Sea, as, judging from Thiele's account, it is a small Turbinid shell with a Turbinid operculum, but with a fairly typical Trochoid radula. Probably many of our austral forms will show similar eccentricities when the animals are examined. In the subfamily *Turbininae* two genera only are admitted, *Astraea* and *Turbo,* with nearly twenty sections. In the subfamily *Phasianellinae* three genera are ranged, *Prisogaster* being here placed, though conchologically it appears quite unrelated; the other two being *Tricolia* and *Phasianella.* As sections of *Tricolia, Chromotis* and *Eulithidium* are allowed, but no sections of *Phasianella* are included.

The preceding synopsis will serve to show that radulae alone are not convincing, but in connection with conchological features and geographical distribution are of the greatest value, and palaeontologists must be guided by the lessons learned therefrom.

Trochus tiaratus Quoy and Gaimard, 1834. [P. 109]

In Iredale's "Commentary" this was placed under the genus *Trochus,* section *Coelotrochus,* the species *T. viridis* being added under the section *Thorista* Iredale. Thiele has admitted the same values, but Cossmann has introduced *Neozelandia* for *Trochus conicus* Hutton, which he has renamed *huttoni.* I have dealt with this matter (*Proc. Mal. Soc.,* vol. 16, pt. 2, p. 99, 1924), and Iredale tells me that independently he had inquired into the proposition with exactly the same conclusions, that *Neozelandia* was unnecessary. At the place mentioned I also added *Trochus* (*Coelotrochus*) *huttoni* (Cossmann) to the Recent fauna. The fossil *Trochus* (*Anthora*) *avarus* Suter (*N.Z. Geol. Surv. Pal. Bull. No.* 5, p. 3, 1917), though not seen, would seem from the figure to belong here though the "2 smooth spirals, starting from the anterior part of the columella and descending into the umbilical excavation" are not quite in accord.

Thoristella carmesina (Webster, 1908). [P. 140]

Suter has placed this species with "*Solariella*" *egena* (Gould), but it does not seem related. I have seen no specimens of this species, nor do any seem to be available in other collections, but if one may judge from Webster's original figure and description (the travesty in the "Atlas" is useless), it seems to be a *Thoristella*. The only factor against this location is the open umbilicus, but this is approached occasionally in the other species, while the remaining details of columella and base can hardly indicate any other genus. The usual Cookian form is *T. oppressa* (Hutton), and it will be interesting if there is a second northern form. Suter records *carmesina* from Cape Palliser, at the not far distant Lyall Bay occur specimens apparently intermediate between *carmesina* and *dunedinensis*—certainly not *oppressa*. The exact valuation of these Cookian forms must be left till much more material is available.

Thoristella (chathamensis) benthicola n. subsp. (Figs. 7-10.)

Shell conic, high, with sharper spire than any of its congeners, sides almost straight, slightly stepped. Spiral sculpture constant; a strong basal keel (weaker than in *chathamensis,* stronger than in the other species) bisected by a deep groove and visible as a suprasutural cord on spire-whorls; six flatly-rounded cords above keel (interstices linear), first and third from keel always much weaker; seven strong cords on base, inner ones closer and narrower, outer ones often with an intercalated thread between. Twenty blunt prominent vertical axial ribs (interstices narrower), rising suddenly from suture to form bluntly-rounded nodules on top spiral cord, remaining strong over next two ribs, which they render undulating, and very quickly fading out on reaching fourth rib, fifth rib only rarely undulated by their terminations, keel not crenulate: axials present on all but the two apical whorls which are spirally ribbed. Umbilicus very narrow, not deep, an outer rib forming its edge, an inner one almost obselete except for slight columella swelling, above which pillar is slightly indented.

Height, 6 mm.; diameter, 7 mm.

Locality,—Dredged off Otago Heads in 60 fathoms (type). Also off Oamaru at same depth, and in 15 fathoms Foveaux Strait.

The sutural swellings give this form a striking superficial resemblance to *Gibbula magus* (L.).

Thoristella [chathamensis] fossilis n. subsp. (Figs. 11-14.)

Related to *aucklandica* and *dunedinensis,* but easily distinguished by basal characters. In all the Recent species the convexity of base is constant immediately past the keel, in the fossil species base slopes quickly up to peripheral keel which is moderately prominent, and shell has a concave outline above it. Six (rarely five) cords above keel (*chathamensis* never has less than 7, sometimes 8), both top cord and keel finely crenulate, occasionally the other spirals also, but there are no axial ribs, and the crenulations are much finer than in the other species, about 65 on peripheral cord (i.e. about five times as many as in *chathamensis*). Umbilicus narrower and deeper than in

Recent species, which all have a greater callus deposit filling it. An outer rib margins the pit, the inner one is inconspicuous, columella with a strong tubercle at top.

Height, 5.5 mm.; diameter, 7 mm.

Locality,—Target Gully Shell Bed (Awamoan,—"Miocene"); also Pukeuri.

This is a direct ancestor to the Recent forms.

Thoristella dunedinensis (Suter, 1897). [P. 108]

A figure is presented (from a topotype) of this hitherto unfigured shell, for comparison with those of the two previous species and the other known forms. (Figs. 15, 16).

Trochus ringens Menke, 1843. [P. 112]

This is a West Australian species of *Clanculus* which must be dismissed from the Neozelanic fauna. The shell that has been erroneously so identified is quite a rare one and differs at sight from Menke's species, as indeed Suter has already noted. The resemblance to *ringens* is entirely superficial, for the New Zealand shell is not even a *Clanculus;* no true members of this genus occur in the New Zealand area. Our shell is imperforate and differs radically from *pharaonicus* L.; it is now described as new.

Paraclanculus peccatus n. gen. and sp. (Fig. 17).

Shell conic, trochiform, with quite straight sides, spire angle of 65°. Colour light yellow-brown, maculated on the two lower cords with regular, slightly oblique, chestnut brown rectangles, 18 on last whorl, base same colour, speckled with brown dots. Four nodulous spiral cords on all whorls, the lowest rapidly becoming strongest; four subequal cords (with narrower interstices) on body-whorl, a strong double keel at periphery, and six narrow cords (with wide interstices) on base. Whorls tabulated at suture which is slightly excavated. Base flat, suddenly expanded downwards near aperture. Aperture rhomboidal, outer lip thin and sharp, the silvery nacre inside with three or four heavy lirae; basal lip with three stronger and much coarser lirae. Outer half of shallow false umbilicus China-white with two smooth circling ribs, a strong projecting bifid denticle at base, with two tiny denticles below and one above it to left; inner half silvery nacreous with another faint rib on outer border and three moderate denticles on lower half.

Height, 11 mm.; diameter, 11 mm.

Locality,—Tryphena, Great Barrier Island.

Mr. Iredale remarks that there is a specimen in the Australian Museum from Mokohinau Island, presented by A. Hamilton; "it is a curious evolution, tall, with peculiar sculpture, not comparable with any other I have come across" (private communication).

Clanculus takapunaensis Webster, 1906. [P. 112]

Mr. Iredale informs me that a co-type of this species in the Australian Museum is very close specifically to *Clanculus plebejus* (Phil.), the genotype of his *Mesoclanculus* (Iredale, 1924, p. 224), and is undoubtedly congeneric with it. "It is less closely related

to *Eurytrochus danieli* (Crosse) from New Caledonia, and is not comparable with *C. atypicus* Iredale from the Kermadecs, the columellar characters being decidedly different." (in litt.).

Genus **Monodonta** Lamarck, 1799. [P. 113]

This genus name, based on *Trochus labio* Linné, must be dismissed from Neozelanic systematics. The species named is a tropical form with a strongly-toothed columella, quite unlike any South Australian or Neozelanic species. As equivalent to *Monodonta*, Thiele has cited "*Trochulus* Mus. Calonn." which has priority, but Humphrey's name is a *nomen nudum*, "*Trochus labio?*" alone being cited. In the British Museum collection four groups are allowed, *Austrocochlea*, *Monodonta*, *Neodiloma* (=*Melagraphia*) and *Diloma*. The radulae in the Gwatkin collection are arranged in the same groupings, and Thiele also admits these. Consequently one can omit *Monodonta* without any arguing whether it be invalid through the prior *Monodon* or not. *Diloma* was furnished for the South American species, which, agreeing conchologically, show distinct animal features, so that it must be ignored also. This leaves *Austrocochlea* and *Melagraphia*, and the former being restricted to the endemic Australian series ranging about *constricta*, *zebra*, etc., *Melagraphia* Gray, 1847 is left as the only valid name for the Neozelanic forms. The type of *Melagraphia* is *aethiops* Gmelin, which is conchologically aberrant, so that new names must be given to the other conchological groups. The Neozelanic forms range themselves into four series, *aethiops*, *lugubris*, *excavata*, and all the remainder. In radular and conchological features the Australian species *melanoloma* (=*rudis*) and *striolata* (=*concamerata*) are apparently allied to the latter Neozelanic series. *Chlorodiloma* is so easily recognizable that it has commonly been separated without question, but the Neozelanic member of this group is of very doubtful status.

The Neozelanic Trochoids are worthy of much attention; they are generally easily procurable, the animals are not shy, and the radulae need careful study. It is noteworthy that Suter should write of *lugubris*, a peculiar form, "dentition unknown." As the four series mentioned are quite distinct and show no intergradation, they may all be regarded as genera, as follows,—

Melagraphia s. str.	Type:	*Turbo aethiops* Gmelin
Zediloma nov. ..	,,	*Zediloma digna* n. sp.
Cavodiloma nov. ..	,,	*Trochocochlea excavata* Ad. & Ang.
Anisodiloma nov.	,,	*Trochus lugubris* Gmelin

In *digna* and *arida* n. spp. (*vide infra*) the presence of a continuous nacreous band across the parietal wall, uniting the ends of the peristome, is a constant and useful feature, associated always with untoothed columella, more excavated base, and spreading aperture, and deserves subgeneric distinction. Accordingly, *Zediloma* s. str. may be kept for these two, and a subgenus *Fractarmilla* may be introduced for *corrosa* A.Ad., *subrostrata* Gray, *atrovirens* Phil., and *morio* Troschel, the first named being nominated as type.

Monodonta coracina (Troschel, 1851) [P. 114]

Reference to Philippi, who published Troschel's MS. name, shows a figure and description applicable only to the species later named *Trochocochlea excavata* by Adams and Angas, for which Philippi's name should therefore be used. *Labio porcifera* A. Ad., included by Suter in the synonymy of his *coracina*, has nothing to do with this species, so that the new name *Zediloma arida* is now provided for the species described and figured by Suter as "*Monodonta coracina*" (*Manual*, p. 114, Pl. 38, fig. 4). I have been informed by several who have had access to the Suter collection, including Dr. Marwick and the late Mr. Murdoch, that it is in a very unsatisfactory state, most of the original specimens being dispersed; the specimens from which the figures in the "Atlas" were drawn were never kept separate, so that it is necessary to select a neotype for the species; I therefore choose as neotype a specimen in the Finlay collection from Lyttelton Harbour, one of the localities mentioned by Suter.

Monodonta nigerrima (Gmelin, 1791). [P. 114]

The true *Turbo nigerrimus* Gmelin is the South American species, and the synonyms quoted by Suter, *Trochus araucanus* d'Orb., *Turbo quoyi* Kiener, and *Trochus gaudichaudi* Hupe all apply to the same form. The Neozelanic species is a southern form, very similar in shell features to the South American species, but with a different animal. The shell is well described by Suter, who has also figured the radula, but, for reasons given in the previous note, I select and figure a type in the Finlay collection from St. Clair near Dunedin (Figs. 24, 25) and name this very beautiful form *Zediloma digna* n. sp. Powell (*N.Z. Journ. Sci. & Tech.*, vol. 6, p. 285, 1924) has recorded the swarming of this species, but for only two months of the year, at Motutara, the first record north of Wellington.

Monodonta excavata (Adams and Angas, 1864) [P. 119]

As already pointed out, this species was described by Philippi under the name *Trochus coracinus* Troschel some years before the above name was proposed. Consequently the species must now be called *Cavodiloma coracina* (Philippi). The peculiar small trochiform shell and almost totally excavated base render this genus conspicuous.

Mondonta lugubris (Gmelin, 1791) [P. 119]

The Cookian and Forsterian forms of this species are easily distinguished. North Island specimens have the three main cingulae stout and all heavily knobbed, especially the peripheral cord, and one weaker but still prominent cord in the interstices; the sides of the aperture are enormously thickened, and the smooth umbilico-columellar area is hardly wider than the band of nacre. Southern specimens, on the other hand, are more depressed, have weaker main cingulae (the upper two almost smooth), with only 3-4 fine smooth ribs in the interstices; the sides of the aperture are quite thin, and the callus-area in the middle of the base is much wider than the nacre-strip; the base is also flatter and less descending. As all the

synonyms of *lugubris* refer to the northern form, it is proposed to distinguish the Forsterian shell by the name *Anisodiloma lugubris lenior* n. subsp. The type chosen in the Finlay collection is from Taieri Beach, five miles south of the Taieri River, and measures (height) 10.5 mm. by (diameter) 14 mm.

This provincial form has been mentioned as an example; almost any of the species when collected in bulk and critically examined will show regional variation.

Monodonta subrostrata (Gray, 1835) [P. 121]

This is closely allied to *corrosa*, and represents this Forsterian form in the Cookian province; *rudis* A. Ad. is an Adelaidean ally. Similarly, *striolata* Q. & G. is a near Australian relative of *atrovirens* Phil.

Chlorodiloma crinita (Philippi, 1848) [P. 121]

This is another West Australian shell and must also be dismissed from the New Zealand fauna. Suter credits the record to Cheeseman; it is well known that some Australian vagrants had crept into Cheeseman's collections, e.g. *Bankivia fasciata, Thalotia conica*, etc., and the present species is but another of these. There are no authentic specimens in local collections; some "New Zealand" specimens so named in the Auckland and Canterbury Museums proved to be not even *crinita*, but the South Australian *adelaidae*. Quite recently Odhner (1924, p. 13) has re-recorded *crinita* from "Bay of Islands, muddy estuary, 7 specimens," but as he has not recorded the common northern *subrostrata* it seems probable that he has misidentified his specimens.* The type of *Trochocochlea mimetica* Hutt., said to be in the Otago Museum, cannot be found, but there are three specimens so labelled in his handwriting which are also *D. adelaidae* and I suggest that these and the type are all Australian specimens, very probably from Cheeseman's original lot, and that, till further information is forthcoming, Hutton's name should be synonymised with *Chlorodiloma adelaidae* (Phil.), and omitted from the New Zealand lists.

Genus **Cantharidus** Montfort, 1810 [P. 122]

The type of *Cantharidus* Montfort is the Neozelanic *Limax opalus* Martyn, and the group is a well defined one, to which may be referred the Southern Australian *Phasianotrochus*, a subgeneric value being apparently the most admissible.

Elenchus appears first in the *Museum Calonnianum* in 1797, but at that place the name is a *nomen nudum*, no references being given to the Neozelanic species named. Mr. Iredale has sent me the following interesting note: "Humphrey wrote '*Elenchus*' and Hermannsen gave as '*Etym.* nom. apell. Conf. seq.,' with a footnote, "Quamvis Swainson ubique *Elenchus* scribat, magis tamen arrideret *Elëuchus*, quod derivandum esset ab ἐλη, lumen; et ἔχω, habeo. Rectus

*Since the above was written, I have received specimens from Odhner labelled "*crinita* (Phil.)"; these are, as I suspected, *M. subrostrata* Gray. On the same basis I can now state definitely that many of his identifications are erroneous, and his records therefore not always trustworthy.

tum scribendum *Heleuchus.*" It is curious how the learned err when they endeavour to force meanings out of names given in Natural Science without thought of the object on which the name was bestowed, as in this instance old Humphrey, who apologised for being but little acquainted with the learned languages, used a word found in Latin dictionaries of his age, "Elenchus ἔλεγχος. A pendant for the ears, consisting of three pear-shaped pearls hanging beside one another, and worn only by rich ladies of distinction," and as the vernacular for his *Elenchus* gave "Poires, ou Pendants d'Oreille—Ear-drop."

The small species allotted to *Cantharidus* form an easily recognizable group, for which I propose the new genus ***Micrelenchus***, with *Trochus sanguineus* Gray as type; this group dates back at least to the "Miocene" in New Zealand (undescribed species in Geol. Survey and Finlay collection), but true *Cantharidus* is at present known only from the Pliocene onwards.

Cantharidus dilatatus (Sowerby, 1870) [P. 122]

To the synonymy of this species should be added *Photinula suteri* Smith, based on a young stage of *dilatatus* and thus lacking the thickened and expanded outer lip. The two diagnoses given by Suter otherwise read word for word alike, and the two forms are always found together in seaweed-washings (especially in the neighbourhood of Wellington). It might be inferred from the ranges given by Suter (though these overlap) that *suteri* is the southern representative of *dilatatus,* but even this view does not seem tenable, for Sowerby's species ranges to Stewart Island, specimens from there being apparently inseparable from northern forms. It has not, however, been found between that locality and Banks Peninsula.

Cantharidus sanguineus (Gray, 1843) [P. 128]

I have not seen Suter's var. *elongatus,* but *coelatus* Hutton, 1884 is a deep water Forsterian representative of Gray's species. Odhner (1924, p. 14) has described a shell from "Auckland Island, Carnley Harbour, 45 fms." as *Gibbula mortenseni* n. sp. This looks at first like a baby *Calliostoma;* from the shape and general appearance it could only be *spectabile* A. Ad., but the swollen pillar and the number of spirals at so early a stage negative its reference to this group. It is evidently a *Micrelenchus,* and appears closely related to *coelatus* Hutton. The latter species is very variable in the number and pustulation of the ribs; many specimens from 60 fathoms off Otago Heads agree generally with Foveaux Strait topotypes, and differ from Snares, Auckland, and Bounty Island specimens only in slightly taller shell and more flexed columella. The latter specimens agree well with Odhner's figure and description (though not always so granulose) so I would regard his species as merely a Rossian form of *sanguineus* Gray, and would write it as ***Micrelenchus sanguineus mortenseni*** (Odhner, 1924).

Cantharidus tenebrosus A. Adams, 1853 [P. 129]

Suter included with this a subspecies "*huttoni* Smith," giving as "Hab.—The same as the species but more abundant." The distinc-

tion accepted by Oliver is gathered from his Ecological Essay in that he records (p. 525) *Cantharidus tenebrosus* from Shag Point, and (p. 536) *C. tenebrosus huttoni* from Otago Harbour, i.e. the species a rocky shore dweller, the subspecies an estuarine form.

To this species should probably be referred the New Zealand records of *Gibbula dolorosa* T.-W. Hedley has discussed this species, referring to it Fischer's *Gibbula scamnata* (*N.Z. Journ. Sci. and Tech.*, vol. 3, No. 1, p. 54, 1920), but it is not known to local workers, and had better be placed on the suspense list for the present.

Photinula coruscans Hedley, 1916 [P. 125]

This was introduced for the species Suter included as *Cantharidus pruninus* subsp. *perobtusus* Pilsbry. The reference to the genus *Photinula* does not seem a happy one, especially in view of the fact that it has been rejected in favour of *Margarella* (Iredale, 1915, p. 438). Since Hedley's proposal, Thiele has separated *Margarella* and *Photinula* into two subfamilies, each different from the *Cantharidus* series. Examination of the shells reported upon by Hedley leaves one in no doubt that they are simply relatives of *Cantharidus capillaceus* (Philippi) and that they should not be classed in *Photinula*. *Trochus capillaceus* Phil., *Cantharidus pruninus* var. *minor* Smith, and *Photinula coruscans* Hedley are all good species, and form a group noticeably differing from *Cantharidus* proper by the greater flexure of the pillar to the right, and the strongly convex early whorls, leading to a depressed dome-shaped apex; *C. opalus* and its congeners rise to a sharp point, the spire being often concave. The subantarctic group, too, has a uniformity of sculpture and colour ("leaden purple, which on the apex changes to bright rose") rendering it at once conspicuous. So far as is at present known the distribution is:—

Capillaceus and *minor* ..	Auckland and Campbell Is.
Coruscans	Macquarie and Antipodes Is.

The Snares and Bounty forms do not seem to have been recorded. Other members of the group probably exist and I provide for it the new name *Plumbelenchus*, with *T. capillaceus* Phil. as type, and would provisionally rank it as of subgeneric value under *Cantharidus*.

Cantharidus fasciatus (Menke, 1830) [P. 130]

Although several localities are given for this Australian species, it seems justifiable to recommend that it and the genus *Bankivia* Beck should be struck off the faunal list. As in the case of *Chlorodiloma crinita*, there are specimens—probably of Cheeseman's "collecting" —in the Auckland Museum, and it is sufficient to remark that in the same box with them are two specimens of the Tasmanian *Phasianotrochus irisodontes* (Q. & G.). Northern collectors have never met with this species, and agree that it should be rejected.

Cantharidus picturatus (H. & A. Adams, 1863) [P. 130]

Omit this from the list of Neozelanic mollusca. Wherever such a shell might have been found in New Zealand, Stuart (sic) Island is surely about the last place to locate it. Iredale, in his "Commentary," noted that Gould's name *lineolaris* has priority over the name

given above, and has since recorded the confusing nature of the Australian Leiopyrgas (1924, p. 225).

Cantharidus conicus (Gray, 1827) [P. 131]

This is also an alien species which must be eliminated from the Neozelanic list. Suter gives "Auckland (T. F. Cheeseman)" and the "Chatham Islands" as the localities whence it has been received, but specimens must be re-collected before even the genus *Thalotia*, of which *conica* Gray is the type, can be admitted as Neozelanic.

Margarella decepta (Iredale, 1908) [P. 133]

This now well-known shell has not yet been figured, and Oliver in his Ecological Essay, dealing with the molluscan associations at Shag Point, has included *Margarella antipoda* (1923A, p. 520) obviously intending this species, described from that locality. Since Oliver in that paper has altered several names without indication, one may conclude he intended to show that he considers *M. decepta* as a synonym of *M. antipoda*, but they are quite distinct.

There are four species of *Margarella* in the Neozelanic region—*M. antipoda* (H. & J.) and *M. macquariensis* Hedley (1916, p. 37) (Rossian), *M. decepta* (Iredale) (Cookian), and *M. fulminata* (Hutton) (Moriorian). This is one of the very useful regional genera, the species live under the roots of kelp, and are all absolutely littoral; the four mentioned constantly characterize their respective provinces. Differential characters may be given thus (*macquariensis* has not been seen and is therefore omitted from the key, but it seems, from Hedley's figure, to be more depressed and to have more clasping whorls than the other species; it is imperforate).

Shell constantly imperforate	*M. decepta*
" " perforate	
Depressed, generally with spiral colour-bands	*M. antipoda*
Fairly high, never with spiral colour-bands, but with zigzag colour-pattern	*M. fulminata*

There does not seem to be a Forsterian form, and the genus is evidently of southern origin. The distribution of the species as given by Suter calls for some comment. First, *Chrysostoma rosea* Hutton was described from "Stewart's Island," and is recorded from various subantarctic islands. The type is definitely determinable as *antipoda* on account of its open umbilicus, depressed form, and spiral red bands; it certainly did not come from Stewart Island, and should —as Iredale has already suggested (1915, p. 439)—be reduced to an absolute synonym of the subantarctic form. Secondly, *Chrysostoma fulminata* Hutton, described as from "Chatham Islands only," is credited by Suter to "Hauraki Gulf to Cook Strait, not common." I have never seen a North Island *Margarella*, and would regard these identifications as erroneous, referable probably to the young of "*Cantharidus*" *dilatatus* Sow. or "*Gibbula*" *nitida* A. Ad.; the true *fulminata* is apparently a very distinctive and restricted Moriorian form. It may also be noted that *decepta* apparently does not range north of Shag Point, Otago, the Southern limit being Stewart Island. To facilitate recognition of this beautiful species, figures are now offered of a specimen in the Finlay collection from kelp roots, Otago Penin-

sula (Figs. 3, 4). Since the type of *decepta* has been lost, I here select this figured topotype as neotype of the species.

Photinula nitida (A. Adams and Angas, 1864) [P. 134]

As suggested by Iredale in his "Commentary," this species appears conchologically referable to *Cantharidella*, founded upon the Australian *picturata* Ad. & Ang. The specific name of the Neozelanic form must be corrected, since Iredale tells me he noted in the British Museum a tablet labelled *tesselata*, upon the back of which was written, "*Margarita tesselata* A. Ad., P.Z.S., 1851, p. 191. Hab.? Types." These were compared with the description and found to agree, and when contrasted with the type set of *nitida* A. Ad. & Ang. were broader and less elevated, but agreed entirely with specimens from Lyall Bay, Wellington. There is a tall form from the west coast of the North Island for which it may be possible to reinstate *nitida*, but since South Island shells agree in detail with Auckland and Wellington specimens, it seems better to admit in the meantime only one species, for which the correct name will be *Cantharidella tesselata* (A. Adams).

Gibbula tasmanica (Petterd, 1879) [P. 136]

What the species is that Suter records under this name is at present unknown. This note serves to point out that the true *Gibbula tasmanica* has proved to have a very anomalous radula, and Thiele has proposed for it a new genus *Nanula*, placing the genus in the family *Umboniidae*. *Nanula*, however, cannot, until further evidence is forthcoming, be included in the Neozelanic fauna.

Genus **Gibbula** Risso, 1826 [P. 135]

This disappears entirely from Neozelanic molluscan systematics. All the species included by Suter have been dealt with in the previous notes, except *Gibbula micans* Suter, and this, until further specimens are available, may be classed under *Micrelenchus*. A resume of the alterations in this genus reads,—

Gibbula tasmanica (Petterd)	Place on the suspense list.
—— *fulminata* (Hutton)	*Margarella fulminata* (Hutton)
—— *micans* Suter ..	*Micrelenchus micans* (Suter)
—— *dolorosa* T.-W ..	**Omit at present.**
—— *suteri* (Smith) ..	*Micrelenchus dilatatus* (Sow.) juv.

Fossarina rimata (Hutton, 1884) [P. 139]

Powell (*N.Z. Journ. Sci. & Tech.*, vol. 4, p. 204, 1921) has found this species living under oysters on rocks at the Bay of Islands.

Genus **Monilea** Swainson, 1840 [P. 140]

Since Iredale wrote in his "Commentary" that *Solariella* might be used to include all the Neozelanic species classed by Suter under the genus *Monilea*, a revolution has been effected in our knowledge of these simple Trochoids.

Peile investigated the radulae of three Australian species, and found that these were so different that shell characters became of secondary importance. The type of *Solariella* is a fossil from the

British Crags, and it is conchologically something like the Neozelanic *S. egenum* (Gould). Notwithstanding this similarity, probably no relationship exists; two Australian shells showing more likeness proved to cover very different animals. Consequently *Solariella* need not be further considered in connection with Neozelanic Recent shells, which have had long lineages of their own throughout the Tertiary. Thiele has used *Solariella* as equivalent to *Machaeroplax,* which is a mistake, as the latter genus is based upon peculiar features of the animal and radula. These peculiar radular characters can be traced throughout the world, in association with different conchological features, as in *Spectamen* from Australia. On account of these radular differences, Thiele has placed *Solariella* in the subfamily Margaritinae, interposing between *Margarites* and *Solariella* all the Eucheloid-Stomatelloid series. It may be that *Machaeroplax* is related to *Margarites,* but no close relationship to *Stomatella* can be easily seen. Thiele places *Minolia* in his subfamily *Umboniidae,* apparently judging the group from the radula of a species allotted to *Minolia* by shell characters, but the type of *Minolia* does not appear to have been examined for its radula yet. The Australian species that Iredale regarded as conchologically agreeing with the type of *Minolia* proved to possess a radula of the *Machaeroplax* style, another unexpected complication. It is quite impossible, therefore, to forecast the radular features of the Neozelanic series, and as they disagree conchologically with Australian shells, I consider the correct course to pursue is to propose new names for the different groups met with in New Zealand, and wait until the animal characters are available to ascertain definitely their generic or subgeneric value. When Iredale introduced the genus *Talopena* for a series of austral shells, he was not referring to Neozelanic forms, and Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 520, 1924) has wrongly utilized *Talopena* in that connection for a new Recent species. *Talopena* develops a tubercle at the top of the columella, and the genus has no Neozelanic representatives. The common species *M. egena* (Gould), proposed as a species of *Solarium* by its author, was the one that recalled *Solariella,* and for it I propose the new generic name *Antisolarium.* In direct lineage may be named *Solariella stoliczkai* (Zittel) from the Awatere beds. The remaining Recent species cannot easily be grouped together, the beautiful shell named *Minolia textilis* by Murdoch and Suter being generically separable from *Minolia plicatula* M. & S. and *M. semireticulata* Suter, while *Monilea carmesina* (Webster) has already in this paper been transferred to *Thoristella.*

For Neozelanic Minolioids I therefore propose the following genera,—

Antisolarium nov.	for	*Solarium egenum* Gould
Zeminolia nov.	for	*Minolia plicatula* Murdoch & Suter
Zetela nov.	for	—— *textilis* Murdoch & Suter
Conominolia nov.	for	*Heliacus conicus* Marshall

The latter species, though also originally introduced as a Solarioid (*Trans. N.Z. Inst.*, vol. 49, p. 453, 1917), from the Palaeocene Wangaloa beds, is the first known member of a well marked early and middle Tertiary Neozelanic group. *S. sulcatina* Suter, from the Kakanui

Tuff's (*N.Z. Geol. Surv. Pal. Bull.* No. 5, p. 5, 1917), is the only other member at present described, but at least five new species are known to me from "Miocene" beds. *Antisolarium* seems to be a late development of *Conominolia*, both have the early whorls regularly diminished to a tiny inconspicuous embryo, a sculpture of only spiral cords or keels, of which three are often more prominent, a narrow but deep umbilicus with crenulated edge, and a peculiar aperture* and sinuous pillar; *Antisolarium* differs in its depressed instead of conic shell, few strong keels, and smooth band on the base. Until transition forms are found, it is preferable to regard these two distinct series as genera.

Zeminolia and *Zetela*, on the other hand, have a disproportionately large and bulbous embryo, and different umbilicus. *Zetela* is by far the older group; besides the type I include the "Miocene" *Solariella praetextilis* Suter (*N.Z. Geol. Surv. Pal. Bull.* No. 5, p. 4, 1917), and some undescribed Tertiary species; the beautiful sharp reticulate sculpture, developing on later whorls into numerous beaded ribs, and the narrower style of umbilicus amply distinguish the genus from *Zeminolia*, which has a very wide perspective perforation. The latter seems to be quite a Recent development, no fossil species being known at present; besides the type I include only *Minolia semireticulata* Suter. Powell (*Rec. Cant. Mus.*, vol. 3, pt. 1, p. 45, 1926) has recently preferred *Spectamen* for this and the other New Zealand Recent species, and *Solariella* for the fossil *sulcatina* Suter, but for reasons given above I prefer to dismiss both these genera.

Genus **Calliostoma** Swainson, 1840 [P. 144]

Thiele's subfamily *Calliostomatinae* does not show whether he has studied the Neozelanic species or not. As he included *Astele* for Australian and American species, he had apparently little material, for the American species he names in connection with *Astele* has no close connection with the Australian type. Iredale has introduced the generic names *Salsipotens* and *Fautor*, for the large and small Australian "Calliostomas" respectively (1924, p. 230). The Neozelanic representatives of the *Fautor* series are the fossil *Calliostoma marwicki* Finlay and C. *cancellatum* Finlay† (*Trans. N.Z. Inst.*, vol. 54, pp. 102, 103, 1923), and the Recent *Calliostoma onustum* described by Odhner (1924, p. 16) from 50 fms. off Cape Maria van Diemen, but the other Neozelanic Recent "Calliostomas" belong to a group quite distinct from *Salsipotens*, which was provided for *armillatus* Wood. They may, for the present, all be classed in one new genus *Venustas* (for which I name *Trochus tigris* Martyn as type), with a subgenus *Mucrinops* nov., typified by *Zizyphinus spectabilis* A. Ad. In *Venustas* s. str. I also place *pellucidum* and *selectum*, together with the following Tertiary species,—*undulatum* Finlay (*Trans. N.Z. Inst.*, vol. 54, p. 104, 1923), *ponderosum* Hutton (*l.c.*, vol. 17, p. 322, 1885), *hodgei* Hutton (*l.c.*, vol. 7, p. 458, 1875) (these two are

*Powell's excellent figures of *egena* (Bucknill, 1924, Pl. 7, figs. 18, a) show this very well.

†Not *C. cancellatum* Schepman, 1908. I have since substituted *Calliostoma temporemuta* (err. typ. for *temporemutata*) nom. nov. (*loc. cit.*, vol. 55, p. 509, footnote, 1924).

possibly synonyms, but much material needs to be examined), *filiferum* Suter (*N.Z.G.S. Pal. Bull. No.* 5, p. 3, 1917), *gracilis* Marshall (*Trans. N.Z. Inst.*, vol. 50, p. 263, 1918), and *fragilis* Finlay (*l.c.*, vol. 54, p. 102, 1923); these forms have a rather sharply-angled periphery, somewhat inconspicuous sculpture, and usually a concave spire with styliform apical whorls, the coiling varying greatly with age. The shells of the subgenus *Mucrinops* have usually a rounded or but slightly-angled periphery, strongly-granulose prominent cords, and a straight or convex spire, the coiling being always regular; here I include *punctulatum, urbanior* n. subsp. (see later), *osbornei* Powell (*Trans. N.Z. Inst.*, vol. 56, p. 591, 1926), and among fossil species, *oryctum, waiparaensé*, and *acutangulum* Suter (*N.Z.G.S. Pal. Bull. No.* 5, pp. 3, 4, 1917), and *suteri* Finlay (*Trans. N.Z. Inst.*, vol. 54, p. 101, 1923). The earlier forms in both groups are a little aberrant, e.g., the two last named have a sharp periphery, but they are small species, and on account of coiling and sculpture are better referable to the subgenus; they may be transition forms. In both groups, too, large size does not seem to have developed until "Pliocene" times, the older "Calliostomas" being mostly small shells. Oliver is describing some further new Recent species in a paper to appear shortly in the *Proc. Mal. Soc.* (*Lond.*), but I have not seen these.

Calliostoma pellucidum (Valenciennes, 1846) [P. 145]

This seems to be the only species of *Venustas* that has no Forsterian representative. The Upper Pliocene *C. undulatum* Finlay is extremely close to this species, and the acquisition of further material enables me to state that the differences given when I described it (*Trans. N.Z. Inst.*, vol. 54, p. 104, 1923) are not of value, but that since the fossil shells seem always to have lower ribs and weaker granules, the name may be retained as a trinomial, *Venustas* [*pellucida*] *undulata* (Finlay).

Odhner (1924, p. 15) has admitted to the New Zealand fauna *Calliostoma trepidum* Hedley, based on two small specimens, 3 mm. in height, dredged in Colville channel and off Cape Maria van Diemen. This record of a Capricorn species may be rejected without any hesitation whatever; apart from the extreme improbability of any subtropical Queensland form—much less a Trochoid—occurring in New Zealand waters, it is evident that Odhner had before him only young shells of *V. pellucidum* (Val.).

Calliostoma punctulatum (Martyn, 1784) [P. 146]

The Forsterian and Cookian forms of this shell are quite distinct, and as the synonyms *diaphanus* Gmelin and *grandineus* Val. both apply to the northern shell, the southern form is now brought to notice as a new sub-species.

Venustas punctulata urbanior n. subsp. (Fig. 27).

Close to the northern *punctulatum* (Mart.), but altogether a more delicate and graceful shell; not so crass; generally depressed rather than conic; whorls far more convex, leading to deeper sutures;

and spirals much thinner and wider apart, and with far finer granules, especially evident on base.

Height, 26 mm.; diameter, 28 mm.

Locality,—Type from 20 fms. Foveaux Strait, common anywhere in the Forsterian Province on the littoral and down to 30 fms.

Calliostoma selectum (Chemnitz, 1795). [P. 146]

This combination cannot be used, as Chemnitz was not a binomialist. Before this name had been used binomially, Griffiths and Pidgeon had published an excellent figure of the species with the name *Trochus cunninghami* (*"Cuvier's Animal Kingdom,"* vol. 12, pl. 1, fig. 7; Index, p. 600, 1834). The plate is dated 1833, and this is the name and date that should come into use. I have recorded large examples of this species (and of *V. tigris*) from 20 fathoms off Otago Heads (*Trans. N.Z. Inst.*, vol. 55, p. 518, 1924); these are really separable from the typical form as a Forsterian representative, and as such I have described it elsewhere in this volume.

Calliostoma spectabile (A. Adams, 1885) [P. 147]

What Suter has figured for this species in the "Atlas" (Pl. 40, fig. 5), I do not know; but it is nothing like the original figure of Adams' species. As neither this nor any other accurate figure of the species is readily available to New Zealand workers, and as this form is the type of *Mucrinops,* I here present a figure of a beautiful specimen in the Finlay collection (Fig. 26), dredged alive in 60 fms. off Otago Heads. The locality "Chatham Islands" given by Suter should be deleted.

Genus **Euchelus** Philippi, 1847 [P. 148]

This genus may be replaced by *Herpetopoma* Pilsbry, 1890, the New Zealand species having a multispiral operculum, and otherwise agreeing generically with *scabriusculus* Angas, the type of this genus. Powell has recently described (*Proc. Mal. Soc.*, vol. 17, Pt. 1, p. 36, 1926) a second New Zealand member of the genus, from Whangaroa, as *Euchelus* (*Herpetopoma*) *larochei;* it is related to *scabriusculus.*

Euchelus Hamiltoni (Kirk., 1882) [P. 149]

Powell has recently figured the unique type of this species for the first time (Bucknill, 1924, Pl. 6, figs. 26, a). I have examined the type specimen, and conclude without hesitation that it is an abnormal form of *E. bellus* Hutton, specimens of which are frequently found with a more or less deep groove in the umbilical area; in the *"hamiltoni"* specimen it is only somewhat deeper than usual, and in all other details the two "species" coincide exactly.

Suter's record [P. 1048] of *E. baccatus* (Menke), which Iredale has shown should bear the name *Herpetopoma aspera* (Phil.) (1924, p. 230), must be rejected, the two New Zealand shells which he so identified representing an undescribed species, related to *aspera,* but differing in details.

Family **Trochidae** [P. 150]

Under this heading Iredale in his "Commentary" advised the admission of the genus *Angaria* to include the two species Suter listed

as *Liotia serrata* [p. 151], and *L. solitaria* [p. 152]. This is an error; Miss Mestayer has recorded that *solitaria* is the juvenile of *Astrea heliotropia* (Mart.), while *serrata* is a true Liotid, allied to *tryphenensis* Powell (see following note) and such Australian forms as *tasmanica* T.-Woods. *Angaria* must therefore be dismissed from the Neozelanic fauna.

Munditia n. gen.

I propose this for the elegant shell described by Powell (*Trans. N.Z. Inst.*, vol. 56, p. 592, 1926) as *Liotina tryphenensis* n. sp. and name in conjunction with it *Liotia serrata* Suter* and the Tasmanian *L. tasmanica* T.-Woods. *Liotia suteri* Mestayer, and a host of Australian species such as *L. botanica* Hedley, *L. australis* Kiener, *L. subquadrata* T.-Woods, etc., possibly represent a different group, but may be included here at present. Iredale (*Proc. Mal. Soc.*, vol. 9, pt. 4, p. 258, 1911) has discussed the name *Liotia*, restricting it to the *cancellata* group; and later remarked (1915, p. 440) that "the type of *Liotia* agrees with *Cyclostrema micans* A. Ad. in every essential particular." This shell has a peculiar facies, a horny operculum, and a thin unvariced aperture. For the large solid Liotids with heavily variced aperture and spiral lines of calcareous particles on the outer side of the operculum (*Liotia* auct., typified by *L. peronii* Kiener) Iredale advocated the use of *Liotina* Fischer, 1885, based on the fossil *L. gervillei* Defrance. As a near relative of *Liotina* was noted *Ilaira* H. & A. Ad. (*Proc. Mal. Soc.*, vol. 9, pt. 4, p. 260, 1911), proposed for *D. evoluta* Reeve, a discoidal shell with "whorls angulated, detached, the last entirely free." None of these groups exactly suits the majority of temperate Australian and Neozelanic Liotias, with their widely umbilicate depressed shells, moderately variced aperture, and simple multispiral horny operculum. Hedley's *Liotia affinis* (*Proc. Linn. Soc. N.S.W.*, vol. 33, pt. 3, p. 483, 1908), noted as having an operculum "similar to that figured for *L. peronii*," would fall very easily into *Liotina*, which seems to be a well marked tropical and sub-tropical group of extremely solid, not very depressed shells, with very narrow cyclindrical perforation. Hedley's *Liotia botanica*, however, (*loc. cit.*, vol. 39, pt. 4, p. 710, 1914), typical of a large South Australian and Tasmanian series, seems to be a temperate relative of the warm water *Liotina;* it has a depressed less heavily ornamented shell, not strongly variced trumped-shaped aperture, and wide umbilicus; Hedley does not mention the operculum, but it is horny, multispiral, with but faint traces of granules. This group is probably separable from *Munditia* nov. s. str., which has a still more planorbid shell, with tendency to reduction of sculpture to knobs on the double keel, very wide perspective umbilicus, lightly variced aperture, and simple horny multispiral operculum.

Liotella incerta (Ten.-Woods)

Why Miss Mestayer has recorded this shell (*Trans. N.Z. Inst.*, vol. 48, p. 125, 1916) is obscure. New Zealand specimens are not like Tenison-Woods' species—which Tate and May (1901, p. 398)

*See nomenclatural note elsewhere in this volume.

have recorded as the immature form of *L. tasmanica* Ten.-Woods. There are many species of *Liotella* in Neozelanic waters, all endemic, and I remove this bad record by proposing for the shell figured by Miss Mestayer (*loc. cit.*, Pl. 12, fig. 5) the name *Liotella indigens* nov.

Family **Cyclostrematidae** Fischer [P. 152]

Suter has included a family of this name, but Iredale has proposed to reject the name altogether (1915, p. 440), counselling the admission of a Family *Liotiidae* Iredale, while pointing out that the usage differed from that usually accepted. Thiele has reverted to the former bad usage—bad because in a systematic revision based on radular characters the use of an indeterminate shell of unknown locality (and of which necessarily the animal is unknown), to typify a family, must be condemned. Thiele states that as he has studied a shell agreeing with Gray's description of his *Liotia*, Iredale's conclusions must be wrong. Iredale studied the type series of Gray's *Liotia*, so that it is more probable that Thiele's shells were wrongly determined. Further, Thiele omitted to deal with *Pseudoliotia* Tate, which Iredale rejected as exactly synonymous with Gray's *Liotia*, and which Thiele should have reinstated. It would not be wise to revive *Cyclostrema* until something definite is known about the type species. Iredale has suggested that if it ever be recognized it will replace the *Liotina* series. I therefore continue Iredale's family *Liotiidae*, and draw attention to Thiele's action with regard to *Elachorbis;* he states this is referable to *Vitrinellidae*, closely allied to *Rissoidae* and *Adeorbidae*. This is quite incorrect, for the genus is obviously Liotid. It is recalled by some European Tertiary forms, but the resemblance is probably quite superficial, and I have already decided not to consider these in connection with austral forms (*Proc. Mal. Soc.*, vol. 16, pt. 2, p. 100, 1924).

Cyclostrema eumorpha Suter, 1908. [P. 153]

Iredale (1915, p. 444) advised that this should be placed with *subtatei* Suter in *Elachorbis*, but the examination of ample material shows that a better location would be in *Lodderia;* it is quite close to *L. lodderae* (Petterd) but is less depressed. As usual, Suter's figure is poor, and shows the aperture too high up. Further undescribed species of *Lodderia* are known to me from northern localities.

True *Elachorbis* is of considerable antiquity in New Zealand, *Circulus cingulatus* Bartrum (*Trans. N.Z. Inst.*, vol. 51, p. 97, 1919), *C. helicoides* (Hutton) (*l.c.*, vol. 9, p. 598, 1877), and *C. politus* Suter (*N.Z.G.S. Pal. Bull. No.* 5, p. 5, 1917) all falling in line with *subtatei*, but I would dissociate from the group *C. inornatus* Marshall (*Trans. N.Z. Inst.*, vol. 51, p. 226, 1919), from the Hampden beds; I have not seen this species and do not attempt to place it from the ineffective figure and diagnosis. A second Recent species of *Elachorbis* has been described as *E. diaphana* Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 518, 1924).

Zalipais lissa (Suter, 1908). [P. 154]

May has reported this from Tasmania (P.R.S. Tas., for 1919, p. 68) but it is improbably the same species. I have described *Z. parva* from the South Island (*Trans. N.Z. Inst.*, vol. 55, p. 518, 1924).

Pseudoliotia imperforata Suter, 1908* [P. 156]

In Iredale's "Commentary," this species from figures and description was transferred to *Leptothyra;* later, recognizing the misuse of *Leptothyra,* Iredale proposed *Collonista* for the Kermadec shell determined as *Collonia picta* Pease, and Finlay has therefore referred to the Neozelanic shell as *Collonista imperforata* (Suter) (*Trans. N.Z. Inst.*, vol. 55, p. 497, 1924).

From Lord Howe Island, minute shells which agreed in every detail with such forms as *Collonia picta* Pease, have been traced to their adult stage, which proved to be *Turbo cepoides* Smith. The range of *Collonista* suggests a Stewart Island habitat as foreign to the genus, and this is fully justified when a series of specimens is examined. I have been able to trace *Pseudoliotia imperforata* Suter definitely as the juvenile of *Turbo granosus* (Martyn), so that *Collonista* and all matter relating to it should be omitted from New Zealand lists.

Juvenile Trochinae have frequently given trouble before, and may be expected to do so also in the future. Thus, in New Zealand, we have the following identities:—

Liotia (*Arene*) *shandi* Hutton, 1873 is juv. *Turbo granosus* (Martyn, 1784)

Pseudoliotia imperforata Suter, 1908 is juv. *Turbo granosus* (Martyn, 1784)

Turbo (*Lunella*) *radina* Webster, 1905 is juv. *Turbo smaragdus* (Martyn, 1784).

Risella kielmansegi Zelebor, 1866 is juv. *Astrea sulcata davisii* Stowe, 1872.

Astralium pyramidale Webster, 1905 is juv. *Astrea sulcata davisii* Stowe, 1872.

Liotia solitaria Suter, 1908 is juv. *Astrea heliotropia* (Martyn, 1784).

Photinula suteri Smith, 1894 is juv. *Cantharidus dilatatus* Sowerby, 1870.

Calliostoma trepidum Odhner, 1924 is juv. *Calliostoma pellucidum* Val., 1846.

We do not yet seem to know the very young stages of *Turbo smaragdus* or *Astrea sulcata,* while the Monodonts, Cantharidi, Calliostomas, and Eucheloids may all be expected to provide problems.

Genus **Brookula** Iredale, 1912.

I have recently dealt with the fossil members of this group (*Trans. N.Z. Inst.*, vol. 55, pp. 526-531, 1924), and proposed a division *Aequispirella* (type: *Scalaria corulum* Hutton) to cover the conic, narrowly-umbilicated, less-sculptured forms. It may be brought to notice here that *B. fossilis* Finlay was inadvertently included in this

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*See nomenclatural note elsewhere in this volume.

division in the "Key to Species," (p. 531) whereas it is a true *Brookula*. It was also suggested, on the strength of a figure published by Miss Mestayer (*Trans. N.Z. Inst.*, vol. 48, Pl. 12, fig. 4, 1916), that *fossilis* should be admitted as a Recent shell. This is now withdrawn, topotypes of Miss Mestayer's shell showing valid distinctions in their more numerous axial ribs (about 36 on the last whorl in adults), taller shell, and weakening of the ribs on base till in the umbilicus they vanish altogether. The name *Brookula prognata* nov. is here advanced for the shell figured by Miss Mestayer (*locality,*—off Big King Is. in 98 fms.). *Brookula funiculata* Finlay also has a distinct Recent descendant, at present undescribed. Hedley has reported a "*Brookula* sp." from Macquarie Island (1916, p. 45).

Lissotesta errata n. sp. (Figs. 28, 29).

Shell close to *L. micra* (T.-Woods), but smaller, and with a not quite complete peristome. Spiral threads are occasionally visible over whorls, generally near suture; about four coarser threads with narrower interstices are developed in umbilicus, which has a subkeeled margin. A rather wide flattish shoulder at suture, merging off imperceptibly into periphery. Suture almost canaliculate.

Height, 1.4 mm.; diameter, 1.3 mm.

Locality,—Snares Is. in 50 fathoms.

This shell has been misidentified as *L. micra* T.-Woods. Iredale, judging from figures and descriptions, associated with this species *Cirsonella granum* Murd. & Suter, and examination of topotypes of both species shows his judgment to have been correct. *Lissotesta* is also of considerable antiquity in New Zealand, the "Miocene" *Lissospira exigua* Suter being hardly separable even as a species from the form described above. *L. granum* also has early Tertiary representatives.

Powell (*Rec. Cant. Mus.*, vol. 3, pt. 1, p. 46, 1926), in describing a new Recent species of *Cirsonella* (*C. parvula,* from 100 f. off Lyttelton), seems doubtful whether *Lissotesta* differs from that genus; but the groups are distinct in texture, altitude, umbilicus, aperture, and operculum, and should both be recognised.

Family **Orbitestellidae** Iredale.

Miss Mestayer has added this to the fauna by describing from the Snares *O. hinemoa* (*Trans. N.Z. Inst.*, vol. 51, p. 131, 1919), which I have recorded also from Bluff oyster scrapings (*l.c.*, vol. 55, p. 517, 1924). Another undescribed species of the genus, probably belonging to Iredale's second group (vide *Proc. Mal. Soc.*, vol. 12, p. 327, 1917) is known to me from dredgings from 12 fathoms, Doubtless Bay; and a third species from shell-sand, Lyall Bay.

Genus **Turbo** Linneus, 1758. [P. 161]

The type of *Turbo* L. is the tropical *marmoratus* L., and this is sufficiently unlike the Neozelanic shells—which are both unusual forms—to make the loss of the name a matter for no regret. *Helix smaragdus* Martyn falls into *Lunella* Bolten, while the quite peculiar *Trochus granosus* Martyn already has a name of its own in *Modelia* Gray, 1840. No Tertiary ancestors of either of these forms are at

present known, but this is certainly due to the almost total lack of quite littoral fossil deposits in New Zealand; the ancestors of such distinct shells must certainly have lived in the same locality.*

Suter admits six species to the Tertiary fauna (*Alph. List N.Z. Tert. Mollusca*, p. 29, 1918), and Bartrum has since added another by describing *Turbo postulatus* n. sp. from Kaawa Creek (*Trans. N.Z. Inst.*, vol. 51, p. 100, 1919). The latter form I have not seen and the figure provides no key to a generic solution. *Turbo superbus* Zittel must also be left alone till good material is available. *Turbo etheridgei* T.-Woods† is an Australian Tertiary form, and its inclusion may be justly doubted. *Turbo approximatus* Suter has been shown by Marwick (*Trans. N.Z. Inst.*, vol. 55, p. 555, 1924) to be a Naticoid, and is now *Magnatica approximata* (Suter)†. Of the remaining three species, two are the Recent forms, and the third, *Turbo marshalli* Thomson is peculiar. This species has been well described by Thomson and Suter (*Trans. N.Z. Inst.*, vol. 40, p. 103, 1907; and *N.Z. Geol. Surv. Pal. Bull. No.* 3, p. 3, 1915), and differs in opercular and shell characters from any named austral group, so I provide for it the new name *Incilaster*, and would provisionally associate with it *Astrea transenna* Suter (*N.Z. Geol. Surv. Pal. Bull.*, *No.* 5, p. 6, 1917; a close Australian ally is the Tertiary *Astralium flindersi* T.-W., from the Table Cape beds (*Proc. Roy. Soc. Tas.* for 1876, p. 95; see also May, *l.c.* for 1918, p. 71, pl. 10, fig. 11), erroneously referred by its author and by Cossmann (*Ess. de Pal. Comp.*, livr. 11, p. 145, 1918) to *Calcar*. As no illustration of *marshalli* is available in later publications, figures are appended of topotypes in the Finlay collection (Figs. 20-23). Rather curiously, what seems to be an exotic congeneric species—from the figures it would not be easy to separate it even specifically—is *Astralium bathyraphe* Smith (*Ann. Mag. Nat. Hist.*, ser. 7, vol. 4, p. 247, 1899) from the Indian Ocean. It has the same simple operculum.

Argalista fluctuata var. **immaculata** (Suter, 1908) [P. 165].

This should be merged in *fluctuata*. The types of both species and variety are from southern localities, and live specimens from the Snares show absolutely the same range of colour and sculpture as Foveaux Strait specimens, which grow to just as large a size.

Powell (*Rec. Cant. Mus.*, vol. 3, pt. 1, p. 46, 1926) has described *Argalista umbilicata* from 100 f. off Lyttelton; a Tertiary ancestral form, with the same wide umbilicus and prominent tongue, occurs at Target Gully together with the ancestor of *fluctuata*, so that the two species have long been differentiated.

Genus **Astrea** Bolten, 1798 [P. 166]

This also should have no place in Neozelanic molluscan systematics, our two well-known forms being both highly abnormal, and

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*Cf. Marwick, who has just lately written of a similar case, "The most probable explanation seems to be that the ancestors of *Chione stutchburyi* and *Protothaca crassicosta* have lived in the New Zealand area since the Cretaceous, but owing to an unfavourable station they were not preserved." (*N.Z. Journ. Sci. and Tech.*, vol. 8, no. 5, p. 272, 1926).

†See nomenclatural note elsewhere in this volume.

only distantly related to *T. imperialis* Gmelin, the type of the genus. For *Trochus heliotropium* Martyn, Montfort's *Imperator* is available, while Lesson has provided *Cookia* for *Trochus sulcatus* Martyn. Of the latter species no Tertiary ancestors are yet known—for the same reason as advanced in the case of our Turbos—but (because of non-littoral habitat) forms closely similar to *heliotropia* are found from the "Miocene" onwards, while Suter's *Astrea bicarinata* (*N.Z. Geol. Surv. Pal. Bull. No.* 5, p. 6, 1917) may perhaps be located in *Imperator*. The Australian Tertiary *Astrea undosa* Chapman has been compared by its author (*Proc. Roy. Soc. Vict.*, vol. 25, N.S., p. 188, 1912) with *heliotropia*, while another Australian fossil ally is certainly *Imperator hudsoniana* Johnston (*Geol. Tas.*, pl. 29, figs. 12, 12a; see also Chapman, *Proc. Roy. Soc. Vict.*, vol. 35, N.S., p. 9, 1922). *Imperator* was thus common to both countries during the Tertiary, but seems to have now no Recent representative in Australia. *Cookia*, however, appears to be represented there by the beautiful *Astralium aureolum* Hedley (*Proc. Linn. Soc. N.S.W.*, vol. 32, p. 492, 1907), described from Mast Head Reef, Queensland, from a single living and adult example, compared by its describer with *sulcata*, and classed "as a second member of the subgenus *Cookia.*" It may be noted that if the form *davisii* Stowe, admitted by Suter as a subspecies of *sulcata*, is really worthy of separation, and if Suter's synonymy is correct, the name it should bear is *Cookia sulcata kielmansegi* (Zelebor, 1866); Stowe's name dates from 1872, and is thus six years too late. I have recorded juveniles of this form from Dunedin Harbour, on muddy weed-covered rocks (*Trans. N.Z. Inst.*, vol. 55, p. 518, 1924).

Astrea subfimbriata Suter (*loc. cit.*, p. 7, 1917), from the "Oligocene" of Pakaurangi Point, Kaipara, is an interesting form as making some approach to the Australian *Bellastrea* Iredale (1924, p. 232). As far as superficial resemblances go, the species is really nearer to *sinius* (Gould) than to "*fimbriata*" (Lamk.), but the relationship is quite distant. The peculiar ornament and base, with its relatively huge callus area, the extremely oblique curved pillar, and the curious nodulation under the periphery form an *ensemble* deserving generic recognition, and I propose *Opella* nov. for it alone. It may be a branch from the *Bellastrea* line, but the differences are too considerable to admit of close relationship.

Phasianella huttoni Pilsbry, 1888 [P. 169]

As already noted, Thiele includes *Prisogaster* in his subfamily Phasianellinae (which is better regarded as a family), with two other genera, *Phasianella* and *Tricolia*. For the latter, Humphrey's name *Eutropia* must be used, and the family name would become Eutropiidae, but the Neozelanic species does not belong to the genus *Eutropia*. Pilsbry has pointed out that the small Australian species have a radula of the Phasianellid style, not of the *Tricolia* (=*Eutropia*) form. Consequently one may propose for the Neozelanic species the new generic name, *Pellax*, associating with it the Australian *rosea* Angas, *virgo*, Angas, etc.

Family Umboniidae [P. 169]

As above noted, Thiele, by means of the radular characters has brought together a peculiar series in the family *Umboniidae,* and consequently amended Iredale's conclusions in connection with this family and generic values. It has been shown that a Minolioid shell may possess an Umbonioid radula, e.g., the common Australian shell previously known as *M. angulata* A. Ad., but which Iredale has renamed *Ethminolia probabilis* (1924, p. 228). This is succeeded by another series such as *M. vitiliginea* (Menke) of Australian workers, which is a *Talopena.* Thiele has also included *Monilea* i.e. *Talopia,* and when these are all studied in connection with true *Umbonium, Ethalia,* and *Ethaliella,* the Neozelanic species with its angulate periphery is a little discordant. Iredale (1915, p. 446) stated that "*Globulus anguliferus* Philippi, given by Suter in the synonymy of "*Ethalia zelandica* Hombron and Jacquinot, 1854," was really published in 1853, and therefore has clear priority over the name assigned to Hombron and Jacquinot, but only published by Rousseau in 1854," and therefore used the name *Umbonium anguliferum* (Phil.) for the species. Unfortunately, this conclusion must be revised, as there is a prior *Globulus anguliferus* J. de C. Sow., 1840 (*Tr. Geol. Soc. Lond.,* vol. 2, pt. 5, expl. pl. 26). The specific name *zelandicum* must therefore be restored, whether it be credited to Rousseau or to A. Adams, who also proposed *Umbonium zealandicum* as a name for this species in the same year (*Proc. Zool. Soc.* for 1853, p. 188, 1854); which has priority is not at present known.

Cossmann has proposed *Ethaliopsis* for the Neozelanic shell (*Essais de Pal. Comp.,* vol. 11, p. 223, 1918), but that name had been used before by Schepman for a different mollusc. I accordingly propose *Zethalia* as a suitable substitute. This kind of shell is not known below the Pliocene in New Zealand, though plentiful in Nukumaruian beds. Powell (*N.Z. Journ. Sci. & Tech.,* vol. 4, p. 205, 1921) has found *zelandica* living in enormous numbers in the littoral zone at Marsden Point.

As a key to the somewhat extensive changes in these groups, a summary is presented of the locations here adopted of all New Zealand members of the Trochacea, both Tertiary and Recent,—

Fam. TROCHIDAE d'Orbigny.

Genus TROCHUS Linneus, 1758. Type: *Trochus maculatus* Linné.

Subgenus COELOTROCHUS Fischer, 1880. Type: *Trochus tiaratus* Q. & G.

Trochus tiaratus Q. & G., 1834.

—— *huttoni* (Cossmann, 1916).

[—— *avarus*] Suter, 1917.

Subgenus THORISTA Iredale, 1915. Type: *Polydonta tuberculata* Gray (i.e. *T. viridis* Gmelin).

Trochus viridis Gmelin, 1791.

—— *camelophorus* Webster, 1906.

Genus THORISTELLA Iredale, 1915. Type: *Polydonta chathamensis* Hutt.

Thoristella carmesina (Webster, 1908).

Thoristella chathamensis (Hutton, 1873).
—— —— *oppressa* (Hutton, 1878).
—— —— *dunedinensis* (Suter, 1917).
aucklandica (Smith, 1902).
(——) *benthicola* nov.
[——] *fossilis* nov.

Genus PARACLANCULUS nov. Type: *Paraclanculus peccatus* nov.
Paraclanculus peccatus nov.

Genus MESOCLANCULUS Iredale, 1924. Type: *Trochus plebejus* Phil.
Mesoclanculus takapunaensis (Webster, 1906).

Genus MELAGRAPHIA Gray, 1847. Type: *Trochus aethiops* Gmelin.
Melagraphia aethiops (Gmelin, 1791).

Genus ZEDILOMA nov. Type: *Zediloma digna* nov.
Subgenus ZEDILOMA s. str.
Zediloma digna nov.
—— *arida* nov.
Subgenus FRACTARMILLA nov. Type: *Labio corrosa* A. Ad.
Zediloma corrosa (A. Adams, 1853).
—— *subrostrata* (Gray, 1835).
—— *atrovirens* (Philippi, 1851).
—— *morio* (Troschel, 1851).

Genus CAVODILOMA nov. Type: *Trochocochlea excavata* Ad. & Ang. (i.e., *T. coracina* Phil.).
Cavodiloma coracina (Philippi, 1851).

Genus ANISODILOMA nov. Type: *Trochus lugubris* Gmelin.
Anisodiloma lugubris (Gmelin, 1791).
—— —— *lenior* nov.

Genus CANTHARIDUS Montfort, 1810. Type: *Limax opalus* Martyn.
Subgenus CANTHARIDUS s. str.
Cantharidus opalus (Martyn, 1784).
—— *purpuratus* (Martyn, 1784).
Subgenus PLUMBELENCHUS nov. Type: *Trochus capillaceus* Phil.
Cantharidus capillaceus (Philippi, 1848).
—— *coruscans* (Hedley, 1916).
—— *minor* Smith, 1902.

Genus MICRELENCHUS nov. Type: *Trochus sanguineus* Gray.
Micrelenchus sanguineus (Gray, 1843).
—— —— *coelatus* (Hutton, 1884).
—— —— *elongatus* (Suter, 1897).
mortenseni (Odhner, 1924).
tenebrosus (A. Adams, 1853).
huttoni (Smith, 1876).
rufozonus (A. Adams, 1853).
oliveri (Iredale, 1915).
dilatatus (Sowerby, 1870). (=*P. suteri* Smith)
micans (Suter, 1897).

Genus CANTHARIDELLA Pilsbry. Type: *Gibbula picturata* Ad. & Ang.
Cantharidella tesselata (A. Adams, 1851).

Genus FOSSARINA Ad. & Ang., 1863. Type: *Fossarina patula* Ad. & Ang.

Fossarina rimata (Hutton, 1884).

Fam. STOMATELLIDAE nov. (=subfam. *Margaritinae* Thiele, *pars*).

Genus HERPETOPOMA Pilsbry, 1889. Type: *Euchelus scabriusculus* Ad. & Ang.

Herpetopoma bella (Hutton, 1873).
—— *larochei* Powell, 1926.

Genus MARGARELLA Thiele. Type: *Margarita violacea* Sowerby.

Margarella antipoda (Hombron & Jaquinot, 1854).
—— *decepta* (Iredale, 1908).
—— *fulminata* (Hutton, 1873).
—— *macquariensis* Hedley, 1916.

Fam. CALLIOSTOMATIDAE Thiele.

Genus FAUTOR Iredale, 1924. Type: *Zizyphinus comptus* A. Ad.

Fautor onustus (Odhner, 1924).
[—— *marwicki*] (Finlay, 1923).
[—— *temporemutatus*] (Finlay, 1924).

Genus VENUSTAS nov. Type: *Trochus tigris* Martyn.

Subgenus VENUSTAS s. str.

Venustas tigris (Martyn, 1874).
—— *pellucida* (Valenciennes, 1846).
—— [——] *undulata* (Finlay, 1924).
—— *cunninghami* (Griffiths & Pidgeon, 1833) (=*selectum* auct.).
regifica Finlay, 1927.
[—— *ponderosa*] (Hutton, 1885).
[—— *hodgei*] (Hutton, 1875).
[—— *filifera*] (Suter, 1917).
[—— *gracilis*] (Marshall, 1918).
[—— *fragilis*] (Finlay, 1923).

Subgenus MUCRINOPS nov. Type: *Zizyphinus spectabilis* A.Ad.

Venustas spectabilis (A. Adams, 1855).
—— *osbornei* (Powell, 1926).
—— *punctulata* (Martyn, 1784).
—— —— *urbanior* nov.
[—— *waiparaensis*] (Suter, 1917).
[—— *orycta*] (Suter, 1917).
[—— *acutangula*] (Suter, 1917).
[—— *suteri*] (Finlay, 1917).

Genus ZETELA nov. Type: *Minolia textilis* M. & S.

Zetela textilis (Murdoch & Suter, 1906).
[—— *praetextilis*] (Suter, 1917).

Genus ZEMINOLIA nov. Type: *Minolia plicatula* M. & S.

Zeminolia plicatula (Murdoch & Suter, 1906).
—— *semireticulata* (Suter, 1908).

Fam. UMBONIIDAE Adams.

Genus CONOMINOLIA nov. Type: *Heliacus conicus* Marshall.
[*Conominolia conica*] (Marshall, 1917).
[—— *sulcatina*] (Suter, 1917).

Genus ANTISOLARIUM nov. Type: *Solarium egenum* Gould.
Antisolarium egenum (Gould, 1849).
[—— *stoliczkai*] (Zittel, 1865).

Genus ZETHALIA nov. Type: *Umbonium zelandicum* A. Ad.
Zethalia zelandica (A. Adams, 1854).

Fam. LIOTIIDAE Iredale.

Genus MUNDITIA nov. Type: *Liotina tryphenensis* Powell.
Munditia tryphenensis (Powell, 1925).
—— *serrata* (Suter, 1908).
—— (?) *suteri* (Mestayer, 1919).

Genus LODDERIA Tate. Type: *Liotia lodderae* Petterd.
Lodderia eumorpha (Suter, 1908).

Genus ELACHORBIS Iredale, 1915. Type: *Cyclostrema tatei* Angas.
Elachorbis subtatei (Suter, 1907).
—— *diaphana* Finlay, 1924.
[—— *cingulatus*] (Bartrum, 1919).
[—— *helicoides*] (Hutton, 1877).
[—— *politus*] (Suter, 1917).

Genus LIOTELLA Iredale, 1915. Type: *Liotia polypleura* Hedley.
Liotella polypleura (Hedley, 1904).
—— *rotula* (Suter, 1908).
—— *indigens* nov. (=*L. incerta* Mestayer, not T.-Woods).
—— (?) *neozelanica* (Suter, 1908).

Genus BROOKULA Iredale, 1912. Type: *Brookula stibarochila* Iredale.

Subgenus BROOKULA s. str.
Brookula prognata nov. (=*Brookula* sp.: Mestayer).
—— sp., Hedley, 1916.
[—— *fossilis*] Finlay, 1924.
[—— *funiculata*] Finlay, 1924.
[—— *pukeuriensis*] Finlay, 1924.
[—— *endodonta*] Finlay, 1924.

Subgenus AEQUISPIRELLA Finlay, 1924. Type: *Scalaria corulum* Hutt.
Brookula corulum (Hutton, 1884).
[—— *tenuilirata*] Finlay, 1924.
[—— *iredalei*] Finlay, 1924.

Genus LISSOTESTA Iredale, 1915. Type: *Cyclostrema micra* T.-W.
Lissotesta errata nov.
—— *granum* (Murdoch & Suter, 1906).
[—— *exigua*] (Suter, 1917).

Genus ZALIPAIS Iredale, 1915. Type: *Delphinoidea lissa* Suter.
Zalipais lissa (Suter, 1908).
—— *parva* Finlay, 1924.

Genus CIRSONELLA Angas, 1877. Type: *Cirsonella australis* Angas.
Cirsonella densilirata Suter, 1908.
—— *parvula* Powell, 1926.

(?)*Genus CONJECTURA nov. Type: *Crossea glabella* Murdoch.
Conjectura glabella (Murdoch, 1905).
(?)*Genus DOLICROSSEA Iredale, 1924. Type: *Crossea labiata* T.-W.
Dolicrossea vesca nov.
*Genus CROSSEOLA Iredale, 1924. Type: *Crossea concinna* Angas.
Crosseola errata nov.
—— *cuvieriana* (Mestayer, 1919).

Fam. ORBITESTELLIDAE Iredale.
Genus ORBITESTELLA Iredale, 1917. Type: *Cyclostrema bastowi* Gatliff.
Orbitestella hinemoa Mestayer, 1919.

Fam. TURBINIDAE Gray.
Genus ARGALISTA Iredale, 1915. Type: *Cyclostrema fluctuata* Hutt.
Argalista fluctuata (Hutton, 1883).
—— *crassicostata* (Murdoch, 1905).
—— *umbilicata* Powell, 1926.
Genus LUNELLA Bolten, 1798.
Lunella smaragda (Martyn, 1784).
Genus MODELIA Gray, 1840. Type: *Turbo granosus* Martyn.
Modelia granosa (Martyn, 1784).
Genus INCILASTER nov. Type: *Turbo marshalli* Thomson.
[*Incilaster marshalli*] (Thomson, 1908).
[—— (?) *transenna*] (Suter, 1917).
Genus IMPERATOR Montfort, 1810. Type: *Trochus heliotropium* Martyn.
Imperator heliotropium (Martyn, 1784).
[—— *bicarinata*] (Suter, 1917).
Genus COOKIA Lesson, 1832. Type: *Trochus sulcatus* Martyn.
Cookia sulcata (Martyn, 1784).
[*Opella subfimbriata*] (Suter, 1917).
Genus OPELLA nov. Type: *Astrea subfimbriata* Suter.
—— —— *kielmansegi* (Zelebor, 1866).

Fam. EUTROPIIDAE nov. (=subfam. *Phasianellinae* Thiele).
Genus PELLAX nov. Type: *Phasianella huttoni* Pilsbry.
Pellax huttoni (Pilsbry, 1888).

Incertae sedis: *Trochus circinatus* Hutton (*Cat. Tert. Moll.*, p. 15, 1873), *Trochus mutus* Finlay (=*T. nodosus* Hutton, preoccupied; *Proc. Mal. Soc.*, vol. 16, p. 99, 1924), *Trochus* (?) *antipodum* and *Calliostoma decapitatum* Wilckens (*N.Z.G.S. Pal Bull. No. 9*, pp. 4, 34, 1922—Cretaceous forms), *Cantharidus fenestratus* Suter (*l.c.*, *No. 5*, p. 3, 1917), *submargarita* (?) *tricincta* Marshall (*Trans. N.Z. Inst.*, vol. 51, p. 227, 1919), *Talopena sublaevis* Finlay (*l.c.*, vol. 55, p. 520, 1924), *Circulus inornatus* Marshall (*l.c.*, vol. 51, p. 226, 1919), *Turbo postulatus* Bartrum (*l.c.* p. 100) and *Turbo superbus* Zittel (*Voy. "Novara,"* Palae., p. 39, 1865).

Nerita melanotragus Smith, 1884. [P. 172]

A paper entitled "Notes on the Radula of the Neritidae," by H. Burrington Baker, was published in the *Proc. Acad. Nat Sci. Philad.*, vol. 75, pp. 117-178, 1923. As this will not be seen by many Neozelanic students, Iredale has kindly sent me a few notes on it

*See later under "Genus **CROSSEA.**"

which may be here given in connection with the genus *Nerita*:—"Baker accepts Montfort's designation of the type of *Nerita* Linné as *peloronta* L., and divides the genus, which differs little from the customary acceptance, into two subgenera, *Nerita* s. str. and *Puperita*. The latter he divides into two sections *Puperita* and *Heminerita*, and the former into four, *Amphinerita, Theliostyla, Pila,* and *Nerita* s. str. The second named subgenus, proposed for *umlaasiana*, a variety of *polita*, is used to cover the Neozelanic *N. melanotragus.* Judging from the characters of the shell and operculum, this is probably correct, but he also notes that the Pacific species *morio* Sowerby, 1833 seems scarcely separable."

The type of the fossil *Nerita nitida* (Hutton, 1873), recently renamed *N. pomahakaensis* by Finlay (*Proc. Mal. Soc.*, vol. 16, pt. 2, p. 100, 1924), has been examined, with a quite unexpected result. Considerable collecting has never brought to light another specimen, and further, no shells from the Pomahaka marls show any traces of colour markings, so that the occurrence of a greenish Nerite with black stripes is more than suspicious. The broken unique type is in fact a Recent Pacific *Theodoxus*, certainly not found in New Zealand—let alone fossil at Pomahaka, and must be dismissed from the fauna.

Fam. **Cocculinidae** [P. 172]

It is questionable whether any of the Neozelanic shells referred to this family (which depends on animal characters) really belong here, since of all of them only the shells are known. From criticism of the North Atlantic typical species one may advocate the dismissal of *Cocculina* from the Neozelanic list, the conchological features disagreeing. Four species are included by Suter, *clypidellaeformis, compressa, craticulata,* and *tasmanica.* When Thiele monographed the group he was doubtful of the location of any of these, and suggested that *craticulata,* judging from the description, might be a *Phenacolepas.* Hedley has used Thiele's genus *Cocculinella,* provided for *minutissima* Smith, for his *coercita,* but Thiele did not so class it.

I would dismiss *Cocculina tasmanica* (Pilsbry) from the New Zealand list, and refer all records of this type of shell to *C. craticulata* Suter, which may be named as type of a new genus *Notocrater,* including therein *tasmanica* Pilsbry and *meridionalis* Hedley.

For the remaining Neozelanic species, *clypidellaeformis* Suter and *compressa* Suter, I propose *Tectisumen* nov., with the first named as type. Here may also be located *C. coercita* Hedley, *C. tasmanica* May, and *Tectisumen mayi** nom. nov. for *Cocculina clypidellaeformis,* May (*Illust. Index Tas. Shells,* Pl. 21, fig. 20, 1923), not of Suter. The outlines of the Tasmanian shell differ from those of New Zealand topotypes, while May, in his original record of the species (*Pap. & Proc. Roy. Soc. Tas.,* 1912 (1913) p. 43), remarked that his shells were "not quite so raised as the type."

*Finlay (*Austr. Assoc. Adv. Science,* vol. 16, p. 343, footnote, 1924) proposed *C. mayi* as a new name for *C. tasmanica* May, but as May's shell was described as a *Cocculinella,* and is not congeneric with *Acmaea tasmanica* Pilsbry, May's name will stand; in *Tectisumen mayi* nov. I perpetuate the intended compliment.

I have seen further undescribed Recent species of *Tectisumen* from New Zealand (e.g. what Miss Mestayer has recorded as *compressa; Trans. N.Z. Inst.*, vol. 48, p. 125, 1916); it has not been found fossil, but *Notocrater* occurs in early Tertiary beds.

Littorina infans E. A. Smith.

"Some small sps., max.h. 1.3 mm., shaken from algae, Cape Maria van Diemen" are the basis on which Odhner (1924, p. 18) has recorded the above Sydney species. This does not need discussion.

Littorina mauritiana (Lamarck, 1822) [P. 188]

Iredale, in preferring the name *Melarhaphe unifasciata* (Gray, 1826) for Australian shells (1915, p. 447) remarked that the New Zealand form seemed separable, and as no name has previously been given to it, I here act on this suggestion—which I am able to confirm—by describing it as new.

Melarhaphe zelandiae n. sp. (Figs. 18, 19).

Shell related to *M. unifasciata* (Gray), but with shorter and less convex whorls, not so inflated. Much darker in colour, uniformly blackish outside, greyish-brown where corroded, inner part of base sometimes whitish; inside rich dark chocolate-brown with a white band below. Spiral sculpture much better marked than in Australian shells, especially on base, interstices not linear, and rendered prominent by their white colour. Peripheral subangulation better marked.

Height, 17 mm.; diameter, 10.5 mm. (type; harbour form).

Height, 11 mm.; diameter, 7.5 mm. (Taieri Beach rock form).

Locality,—Dunedin Harbour, on rocks at half and high tide level.

Laevilitorina hamiltoni (Smith, 1898) [P. 190]

This form does not agree conchologically with *caliginosa*, the type of the genus. There is an undescribed closely-allied form at the Auckland Islands, and probably search at Campbell, Bounty, and Antipodes Islands would reveal further members. For this group is proposed *Macquariella* nov., with *Paludestrina hamiltoni* Smith as type, allowing it subgeneric rank under *Laevilitorina*.

Finlay, (*Trans. N.Z. Inst.*, vol. 55, p. 522, 1924) has recently recorded the genus from the mainland, describing two new forms, *L. micra* and *L. cystophora*. These looked conchologically aberrant, and are now shown to be widely sundered from *Laevilitorina*. This genus and *Macquariella* agree in having a paucispiral Littorinoid operculum, and Finlay has stated that this in his shells is "normal." Dissection of further specimens shows, however, that though appearing normal while deep within the aperture, the minute operculum in both species is really not spiral at all, but pyriform, with a medio-lateral nucleus. Many other undescribed species of this group, all minute, are now known from the mainland, while Brookes has described one from the North Island (*L. iredalei* Brookes; *Trans. N.Z. Inst.*, vol. 56, p. 589, 1926), and I signalize their distinction from *Laevilitorina*—which, so far as the Neozelanic region is concerned, is restricted to the Rossian province—by the proposition of a group name, *Zelaxitas* nov., naming *L. cystophora* Finlay as type.

Fam. **Fossaridae** Fischer [P. 192]

Odhner (1924, p. 18), in admitting the type genus to the Neozelanic fauna, has associated under it an incongruous assemblage of forms, covering at least three genera, none of which has anything to do with true *Fossarus*. For clearness' sake one may propose the necessary new genera now, and then proceed to discuss them,—

Zeradina nov.	for	*F. ovatus* Odhner.
Nilsia nov.	„	*F. conicus* Odhner.
Scrupus nov.	„	*F. hyalinus* Odhner.

Odhner's *F. ovatus* and *F. productus* may be regarded as congeneric, both having a blunt paucispiral embryo, a complete peristome, and a groove behind the inner lip; with these may be associated the Tertiary *Couthouyia concinna* Marshall and Murdoch *(Trans. N.Z. Inst.*, vol. 53, p. 80, 1921) and, provisionally, *Lacuna exilis* Murdoch *(loc. cit.*, vol. 32, p. 220, 1900) and *Aclis costellata* Hutton *(loc. cit.*, vol. 17, p. 319, 1885). The Recent *Couthouyia corrugata* Hedley is near to these but has a tiny apex, expanded whorls, and a deep, keeled umbilicus spreading from the groove; it does not belong to *Couthouyia,* and the new name *Radinista* may be supplied for it alone at present, taking subgeneric rank under *Zeradina.*

Odhner's third species, *F. conicus,* is quite a different kind of shell, having only the fine spiral sculpture in common with the previous series. The apex is minute, of several whorls, almost pointed, the peristome is considerably broken by the convex parietal wall, and there is no groove behind the inner lip. I nominate it as type of *Nilsia* nov., and place it at present near *Dardanula* in *Rissoinidae; Rissoina cuvieriana* Suter is apparently congeneric, and though Suter's figure and dimensions differ considerably from Odhner's, I suggest that when his unique type is examined it will prove to be the same species; if that is so, Suter's name has precedence.

Fossarus hyalinus, Odhner's last species, is about as far removed conchologically from *Fossarus* as it could well be. The thin hyaline test, depressed dome-shaped and glossy two-whorled apex, quite incomplete peristome, perforate umbilicus more or less filled by a callus-pad, deep sutural triangular sinus in the outer lip, deep rounded notch in the basal lip, and swollen subplication low down on the pillar, form a very curious combination of characters. I give it a name of its own in *Scrupus* nov. and provisionally associate with it *Cithna marmorata* Hedley, and perhaps *Fossarus minutus* Petterd,* locating the genus temporarily in the neighbourhood of *Cithna* which, in an exaggerated way, it somewhat resembles, except for the posterior sinus. Odhner's record of *F. minutus* from Hauraki Gulf cannot be accepted; identified specimens he has sent me belong to *Notosetia* (s.l.) and are in no way related to *Scrupus hyalinus.*

Planaxis brazilianus (Lamarck, 1822). [P. 194]

Definite evidence regarding the authenticity of New Zealand examples of this shell—which should be generically called *Hinea*—is not yet forthcoming, and till it is the species should be placed on the suspense list. It is, however, common at the Kermadecs.

***For nomenclatural note on this species, see elsewhere this volume.**

Family **Rissoidae** Gray [P. 198]

I have given some account of the Tertiary Neozelanic species, with generic and specific keys (*Trans. N.Z. Inst.*, vol. 55, pp. 481–493, 1924) and have there added several new species and the Australian genus *Epigrus* Hedley (*Mem. Austr. Mus.*, No. 4, p. 355, 1903) to the Tertiary fauna.

The genus *Amphithalamus* must be rejected as Iredale suggested, for even if it were applicable to some Australian forms, the Neozelanic *hedleyi* is typical of a very distinct group, and for this species I therefore propose the new generic group *Nannoscrobs*. It may be noted that probably *Scrobs* is characteristic of an Australian Family, for many species are being discovered belonging to two or three distinct groups, one centering round shells like the American *Amphithalamus* (but probably not at all related), another of shells like Watson's *Scrobs scrobiculator* which appear to be of a slighter texture, and some smaller thinner species, rather like *Scrobs*, which constitute the group named *Nannoscrobs* above. The two former have not yet been recorded from New Zealand itself, though known from the Kermadecs. Odhner's *Rissoa semen* may be located in *Nannoscrobs*, but his *R. erosa*, with its squat shell and heavy ornament, is a different style of "*Amphithalamus.*"

Hedley (1916, p. 46) has added *Eatoniopsis* to the fauna by describing *E. ainsworthi* from Macquarie Island. The fossil *Rissoa vana* Hutton (*Cat. Tert. Moll.*, p. 12, 1873) I have shown to be a subfossil *Potamopyrgus* (*Trans. N.Z. Inst.*, vol. 55, p. 491, 1926).

Elsewhere in this volume Powell describes sixteen new Recent species, a welcome addition to the fauna.

Rissoa cheilostoma Ten.-Woods, 1877 [P. 202]

This name must disappear from New Zealand lists, as Iredale has already suggested (1915, p. 449). Its place will be taken by *Merelina lyalliana* (Suter, 1898), described from Lyall Bay; as this shell has never been figured, illustrations of topotypes in the Finlay collection are appended (Figs. 35, 36). Numerous specimens of *Merelina* are known to me from New Zealand waters, representing two or three groups; I have already proposed (*Trans. N.Z. Inst.*, vol. 55, p. 483, 1924) the genus *Linemera* (type: *L. interrupta* Finlay = *Rissoa gradata* Hutton*) to cover forms with Merelinid sculpture, but a smooth glossy apex, while Powell (*l.c.*, vol. 56, p. 593, 1926) has introduced *Promerelina* for two extreme forms of this group, *P. crosseaformis* and *coronata* Powell, both Recent species. For shells like *Lironoba* in sculpture, but with a smooth glossy apex like *Linemera*, I have proposed *Nobolira* (type: *Lironoba polyvincta* Finlay) (*Trans. N.Z. Inst.*, vol. 56, p. 227, 1926).

Powell (*Rec. Cant. Mus*, vol. 3, pt. 1, p. 46, 1926) has added to the Recent fauna *Haurakia venusta*, from 100 f. off Lyttelton, stating that *Haurakia* has the protoconch "sculptured with exceedingly fine uneven spiral striae," and that his species has "a striking resemblance to Finlay's *Linemera*, which is only superficial, however, the nucleus being quite smooth and glossy in the latter genus." Nevertheless, I would refer *venusta* without hesitation to *Linemera*, as the

*See nomenclatural note elsewhere in this volume.

southern representative of the Cookian deep-water *pingue* Webster. which is a close ally of *gradata* Hutton, the genotype. I would restrict *Haurakia* at present in New Zealand to the type (*hamiltoni*), *huttoni* Suter, and the Tertiary *oamarutica* Finlay (my *H. mixta* should, I think, be dropped; the type was irreparably damaged during illustration, and the sole paratype proves to be a juvenile abnormal *Estea impressa*): when the austral Rissoids are monographed, *Haurakia* will probably become a monotypic genus, as *hamiltoni* differs in habitat and facies from all the other species referred here. I cannot understand Powell's description of the apex of this species and *venusta*. *Linemera* differs from *Haurakia* most noticeably in development of spiral sculpture, but both genera have a smooth and glossy paucispiral apex, that of *Haurakia* being more depressed, slightly inrolled at the tip, and with a less marked terminal varix. But under a high power, and in very strong sunlight, the shells *and the apices* of both groups are seen to be of a minutely porous structure (much as in *Terebratella* and other brachiopods), and the very fine dense punctures occasionally give the effect of running together in spiral lines. This is probably what Powell mentions as "spiral sculpture," and no more than this is visible in my topotypes of *hamiltoni* on the one hand, or of *exserta, pingue, gradata,* and *venusta* on the other. Quite different is the true spiral sculpture (often heavy) seen on the embryos of *Merelina, Promerelina, Lironoba, Anabathron, Attenuata,* and *Brookesena (vide post).*

Merelina plaga n. sp. (Figs. 37, 38).

Shell similar to *M. lyalliana,* but of weaker build, though slightly larger. Number and disposition of spiral ribs the same, except that subsutural rib stronger, and the two on the periphery subequal, giving the spire-whorls a half-hexagonal instead of a triangular outline; body-whorl thus loses its angled periphery. All spiral ribs thinner, interstices three to four times as wide instead of same width, axial ribs slightly less numerous and weaker; nodules at intersections much smaller; axials and spirals thus enclose large square meshes instead of small rectangular pits. Aperture larger, more obliquely oval than subcircular. Other details as in Suter's species.

Height, 3 mm.; diameter, 1.3 mm.

Locality,—Snares Islands, in 50 fathoms.

Rissoa incidata (Fraunfeld, 1867) [P. 208]

Omit this species; Suter's records apply to species of *Estea;* one that I have seen, from Lyttelton, is a *lusus* of *E. minor* which developed a groove for a short distance following a fracture. In passing, it may be mentioned that Odhner's record (1924, p. 22) of *Rissoa subfusca* Hutt. is, from examination of shells sent by him, based also on *Estea minor* (Suter), so that this species does not appear to be at all well understood.

Rissoa roseola Iredale (=**rosea** Hutton) and **Rissoa roseocincta** Suter. [P. 209]

Transfer these species to *Dardanula.* In connection with *Dardanula fuscozona* (Suter), it may be noted that of two specimens so identified and sent to me by Odhner, one is a *Dardanula* n.sp., the other a *Zelaxitas* sp., cf *iredalei* (Brookes).

Ancestral to *D. limbata* is the Tertiary *D. rivertonensis* Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 491, 1924).

Rissoina hanleyi Schwartz, 1860. [P. 219]

Several species seem to be masquerading under this name. Odhner (1924, p. 23) has recently split off one good species as *Rissoina achatina* nov., but recorded *hanleyi* also; there are at least two others in the compound remaining, and in describing one of them I now dismiss this Philippine Island species from the New Zealand fauna.

Rissoina anguina n. sp. (Figs. 39, 40)

Shell stout, shining, generally milky white with broad chestnut-brown band just below periphery, and a narrower subsutural one; sometimes there are several tawny-yellow bands instead, or the whole shell may be blackish-brown or orange-yellow. About 24 axials per whorl, interstices 2–3 times as wide; they have fairly wide bases but rapidly narrow and become sharp, obsolescent on body-whorl; whole shell with dense fine spiral grooving. Spire about 1½ times height of aperture, outlines faintly convex. Other details as mentioned by Suter in his diagnosis of *R. hanleyi.*

Height, 5.5 mm.; diameter, 2.5 mm.

Locality,—Whangaroa Harbour

Omalogyra bicarinata Suter, 1908 [P. 229]

This shell has no affinity with *Omalogyra,* but is closely related to the form described by Miss Mestayer as *Discohelix hedleyi* (*Trans. N.Z. Inst.*, vol. 48, p. 125, 1916). *O. bicarinata* was described from the Snares in 50 fms., and related forms are known to me from northern localities, while *D. hedleyi,* described from off Big King Island in 98 fms., has similar southern relatives. For this series I propose the genus *Zerotula* nov., with *D. hedleyi* Mestayer as type; no congeneric Australian forms are as yet known. The species are all small and discoidal, the shells usually somewhat shining and with a simple ornament of two or three strong keels on the periphery, otherwise smooth except for faint corrugations on the upper and lower surfaces and occasional weak serrations on the two outer keels; the aperture is squarish with a complete peristome. Miss Mestayer's location of the species in the Family *Architectonicidae (loc. cit.*, vol. 51, p. 132, 1919) seems reasonable, the apex being slightly inrolled. There may perhaps be relationship with *Discohelix,* or such *Discohelix*-like forms as *Omaxlaxis meridionalis* Hedley. The forms are certainly adult and not the juvenile stage of some Trochoid.

Genus **Tatea** Ten.-Woods, 1879.

Hedley (1916, p. 46) has introduced this genus to the Neozelanic region by describing *Tatea melvilli* nov. from Macquarie Island. Brookes has added a second species (*Trans. N.Z. Inst.*, vol. 55, p. 153, 1924), *Tatea hedleyi,* from Rangitoto Island, but Iredale informs me that this shell is really *Assiminea nitida* (Pease, 1865), *(Proc. Zool. Soc.*, 1864, p. 674), which is distributed throughout Polynesia, and has been recorded from the Kermadecs by Oliver *(Trans. N.Z. Inst.*, vol. 47, p. 522, 1915).

Melanopsis trifasciata Gray, 1843 [P. 236]

The genus *Melanopsis* is based on a European form, and all monographers have noted the distinction of the Neozelanic group without providing a distinctive name. for it. As the genus is represented in the early Tertiary (by *Ancillaria pomahaka* Hutton; *Cat. Tert. Moll.*, p. 6, 1873; see also Suter, 1915A p. 6), I have no hesitation in proposing *Zemelanopsis* n.gen., naming this species as type. Another group of " *Melanopsis* " existed in the New Zealand Tertiary, of which *Coptochetus zelandicus* Marshall (*Trans. N.Z. Inst.*, vol. 50, p. 265, 1918) and *Melanopsis waitaraensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 317, 1926) are members; Dr. Marwick has noted that they have the aperture of *Zemelanopsis*, but differ in their strong sculpture; this is of at least subgeneric importance in this group, so that I now separate them under the name *Pakaurangia* n. subgen., with *M. waitaraensis* Marw. as type.

Fam. **Cerithiidae** Fleming [P. 236]

The only members of this family admitted by Suter are referred to two genera, *Cerithidea* and *Bittium,* four species being allotted to the former, a tropical mangrove form, and six to the latter, a British type. Both generic names must be dismissed from the Neozelanic fauna, and some of the species also. First, the recognition that a Neozelanic species is establishing itself in Australia necessitated a criticism of the species, with the result that Suter's first species, *Cerithidea alternata* Hutton, was found to be based on an Australian specimen of *Cerithium australis* Q. & G., and not to be of Neozelanic origin. The type in the Dominion Museum has been examined, and this fact is evident. Secondly, Iredale tells me that the species name *bicarinata* Gray, 1843, is invalid, but that the substitute *lutulentum* Kiener was published in 1842, and was therefore the valid name all the time. Thirdly, the next two species must be lumped, since Hutton's *tricarinata* is simply an individual variant of Sowerby's *subcarinata* —this is the species that has gained an Australian foothold; it is extremely common and spreading rapidly at Freshwater, near Manly, Sydney. Lastly, the whole series, now reduced to two species, has nothing much to do with the genus *Cerithidea*—which was introduced by Swainson for a very different mangrove Cerithioid—and must be separated as a distinct genus, for which the new name *Zeacumantus* is proposed, Sowerby's *subcarinata* being named as type. In direct lineage may be noted *Ataxocerithium perplexum* Marshall and Murdoch (*Trans. N.Z. Inst.*, vol. 51, p. 254, 1919) and *Cerithidea tirangiensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 317, 1926). Iredale tells me that the South Tasmanian species *diemenensis* Q. & G., referred at the present time to *Pyrazus,* a poor decision, is congeneric.

With regard to the genus *Bittium,* Suter wrote, "Operculum 4-whorled, with central nucleus," and of *Bittium exile* Hutton noted "Operculum normal." Suter also included *Bittium granarium* Kiener, 1842, and *Bittium lawleyanum* Crosse, 1863, in each case observing, "Operculum normal." These two well-known Australian species form no part of the Neozelanic fauna, and must be eliminated from the records. As a matter of fact, the operculum in these species is not "normal" in the sense used by Suter, but has proved to be

truly Cerithioid, and for the former Iredale has provided the genus name *Cacozelia* (1924, p. 246), while the specific name of the East Australian species Hedley has shown to be *lacertinum* Gould (*Proc. Linn. Soc. N.S.W.*, vol. 41, p. 310, 1923). Crosse's *lawleyanum* appears to be congeneric with this species. Suter has also included *Bittium cylindricum* Watson, 1881, a Port Jackson species, for a Foveaux Strait shell: this name must also disappear.

This leaves only three species, two of which are congeneric, viz., *Bittium exile* Hutton and *Bittium vitreum* Suter. For these a new name *Zebittium* may be introduced, the former being cited as type; the exact position of the group may be held over until further information regarding the operculum and radula is obtained. The early Tertiary *Cerithidea minuta* Marshall (renamed *C. marshalli* by Cossmann; see elsewhere in this volume) may perhaps be included here. *Bittium retiferum* Suter does not, however, belong to this group, but must be included in the following series.

The family *Cerithiopsidae* may be rejected since it is based purely on features of the animal of a British species, and there is not the slightest fact to connect this with the species allotted to the family by Suter, not even the operculum of any being recorded. A much safer procedure is to leave these under the family *Cerithiidae* until the animals are investigated, and to use definite group names for the series such as (a) *sarissa, acies,* and *subantarctica,* with a many-whorled reticulate apex* ending in a carina; (b) *retifera, canaliculata, marginata,* and *styliformis,* with a few-whorled smooth and rounded apex: and (c) *crenistria,* a peculiar form. Suter has included *C. cessicus* Hedley, a Tasmanian species, recording it from the Snares in 50 fathoms. The Tasmanian shell is referable to *Joculator* Hedley, but Suter has written, "Protoconch papillate, of 1½ whorls, the first smooth and shining, the remainder distantly plaited," a description which does not apply to *Joculator,* so that the species name *cessicus* is inapplicable and must be rejected. True *Joculator* does seem to occur in northern New Zealand, and here may be provisionally located Odhner's new *Cerithiopsis dirempta* (1924, p. 26), the apex of which is not known.

Another name involved in this holocaust is *Newtoniella,* which Iredale has shown must be replaced by *Cerithiella,* but this latter also merits rejection as previously suggested by the same writer *Trans. N.Z. Inst.*, vol. 47, p. 455, 1915). Odhner has described a shell (1924, p. 27) as *Cerithiopsis trizonalis* nov. which is congeneric with *Newtoniella stiria* Webster; he has supplied a good figure and full details of the apex, which begins with a smooth whorl, then has two more with axial costae, developing spiral keels towards its close. A fifth group is represented by a common Tertiary species, *Cerithiella fidicula* Suter, which has a very tall, cylindrical, polygyrate, perfectly smooth and glossy embryo. *Cerithiopsis aequicincta* Suter, another widely-spread Tertiary form, has a rather short, keeled, polygyrate, "Daphnellid" apex, and may be associated with the *sarissa* group. Finally, the Tasmanian *Cerithiopsis apicicostata* May

*Suter has described all these species as having a smooth protoconch; this is incorrect, well-preserved specimens showing Daphnellid reticulation on all whorls, the forwardly sloping curved threads stronger.

(*Pap. and Proc. Roy. Soc. Tas.*, p. 64, 1919) represents a group not yet recorded from New Zealand, but of which I have new species; the apex, well figured by its describer, is paucispiral, rather swollen and flattened on top, ornamented all over with quite strong axial ribs; this group may be near *crenistria,* but the latter has a much larger and more massive shell, different aperture and ornament, and a diverse type of axial ornament on the embryo, the ribs being heavy, wide, and flattish, on a bulbous, almost planorbid, few-whorled apex; as Suter's illustration was drawn from a juvenile and does not well show the canal, I refigure this fine species (Fig. 42) from a specimen, in the Finlay collection, dredged off Otago Heads in 60 fathoms. I propose to designate these groups as follows:—

Specula nov.	for	*C. styliformis* Suter.
Alipta nov.	"	*C. crenistria* Suter.
Mendax nov.		*C. trizonalis* Odhner.
Socienna nov.		*C. apicicostata* May.
Zaclys nov.		*C. sarissa* Murdoch.
Miopila nov.		*C. fidicula* Suter.

Of these, the third and fourth are not yet known as fossils, but all the others have known or undescribed Tertiary representatives in "Miocene" and older beds in New Zealand. *C. mamilla* May and *C. turbonilloides* Ten.-Woods represent *Specula* in Tasmanian waters, while *C. semilaevis* Ten.-Woods and *C. dannevigi* Hedley can easily be referred to *Zaelys.*

Genus **Seila** A. Adams, 1861 [P. 250]

This name seems inapplicable to any of the Neozelanic forms, which, as in *Cerithiopsis,* fall into several groups, easily defined by apical characters. As the Tertiary species need further study, and some of these are not available to me, I defer full division of the group, and merely propose *Notoseila* nov. for the common *Cerithium terebelloides* Hutton (of which the protoconch is "long, cylindrical, of 4 convex and smooth whorls, the nucleus mamillate") and *Hebeseila* nov. for *S. bulbosa* Suter, which has the protoconch "globular, of 1½ smooth whorls, the first bulbose, of greater diameter than the next few whorls." *Notoseila* is the only group of *Seila* that extends throughout our Tertiaries, for here belongs *S. attenuissima* Marshall and Murdoch (*Trans. N.Z. Inst.*, vol. 52, p. 129, 1920), and there are several new "Miocene" species. The only other fossil species is the late Pliocene *S. huttoni* Suter (*N.Z.G.S. Pal. Bull. No. 3*, p. 6, 1915), but this is related to *S. chathamensis,* and these two may for the present be located in *Hebeseila. S. cochleata* Suter may be reduced to a synonym of *S. chathamensis* until the unique type (which appears to be based on a worn and distorted shell) is made available for examination. Fresh Whangaroa specimens, which I take to be practically topotypes of *cochleata,* do not differ from Chatham Island and Auckland specimens of *chathamensis.* The latter name has priority, being published in *Proc. Mal. Soc.*, vol. 8, p. 37 (April, 1908), while *cochleata* appeared in *Trans. N.Z. Inst.*, vol. 40, p. 361 (June, 1908). *Seila dissimilis* Suter, excellently figured lately by Odhner (1924, Pl. 1, f. 18) stands out from the other species, which have a characteristic uniformity of habit and sculpture, and differ mainly in apical

features; it has faint axial ribs and nodulations, and may be grouped at present near *Cerithiopsis styliformis* Suter, *i.e.*, in *Specula;* but here again Suter's type must be examined before one can be quite sure of what he described. A somewhat similar Australian form seems to be *Cerithiopsis turbonilloides* May. Among other Australian species, *Seila albosutura* Ten.-Woods seems congeneric with *S. terebelloides,* while *S. halligani* Hedley may be located in *Hebeseila. Seilarex* Iredale (1924, p. 246), type: *Seila attenuata* Hedley, seems from the description related to *Notoseila,* but actual specimens differ widely in texture, facies, and features of aperture, and show that no close relation to any of the New Zealand groups exists.

Genus **Ataxocerithium** Tate, 1894.

Marshall and Murdoch have stated that the fauna of the Castlecliff beds "differs from the Recent fauna only in the presence of *Ataxocerithium*. . . ."; this distinction has now been removed by Odhner, who has described *Cerithium invaricosum* from off Moko Hinau Island in 5 fathoms, and this species immediately falls into line with a series of Neozelanic fossil forms. Unfortunately Odhner was not acquainted with these, and was not able to compare his Recent specimen with Pliocene shells; this is to be regretted since topotypes of his shell are identical with the Castlecliffian *A. huttoni* (Cossmann) (*vide* Suter, *N.Z.G.S. Pal. Bull. No.* 2, p. 14, 1914). Odhner's figure and description might well stand for a Castlecliff shell, the apparently more sparse axials being due to the smallness of his specimen.

I have lately treated of the New Zealand members of this genus (*Trans. N.Z. Inst.*, vol. 55, p. 475, 1924), but the acquisition of further material enables me now to amend one or two erroneous conclusions there. The type of *A. pyramidale* subsp. *robustum* Finlay consisted of only some of the apical whorls; curiously enough, in the remaining unsorted material from the same locality the remainder of the shell was discovered, and it now proves to grow into *A. quadricingulatum* Finlay. The shell is worth full specific rank, and will bear the prior name *robustum* Finlay. This evidence also seems to warrant the union of the two "Miocene" forms described as *pyramidale* and *nodicingulatum,* both of Finlay, the former having priority. Doubt was expressed at the time as to whether one might not be the fully-grown form of the other, and I am now satisfied that it is. There can be little question that a direct lineage is represented here, — *pyramidale (= nodicingulatum)* [Miocene], *robustum (= quadricingulatum)* [Pliocene], *huttoni (= invaricosum)* [Uppermost Pliocene and Recent]. The first species is abnormal in occasionally showing a denticular plait on the middle of the pillar, but it is more usually absent, and in the later members never present; except for this feature these shells appear absolutely congeneric with *Cerithium serotinum* Adams, the type of *Ataxocerithium* Tate, and it may be noted that the Australian Tertiary ancestors of this species (e.g. *A. concatenatum* Tate) also occasionally possessed a rudimentary plait. *A. tricingulatum* Marwick (*Trans. N.Z. Inst.*, vol. 55, p. 194, 1924) is probably an offshoot from this lineage.

Ataxocerithium suteri Marwick (*l.c.*, p. 195) has, however, little to do with this series; peculiar in form, and possessing always a strong medial columellar plait, it demands separate recognition, which is given by providing for it alone the name *Taxonia* nov.; ancestors and descendants have not yet been found.

Genus **Batillaria** Benson, 1842.

This was introduced into New Zealand Tertiary lists by Harris (*Cat. Tert. Moll. B.M., Pt. 1*, p. 229, 1897) when he renamed Hutton's *Cerithium nodulosum*. I now reject it, and note that *B. pomahakaensis* Harris, *Cerithium hectori* Harris, and *Turritella ornata* Hutton, appear to be congeneric, and demand a new genus. This is provided in another paper in this volume.

Zefallacia n. gen.

I propose this for the Tertiary *Fastigiella australis* Suter (*Trans. N.Z. Inst.*, vol. 51, p. 68, 1919). This species has little affinity with *Fastigiella carinata* Reeve, an Antillean species, but is a member of a group of species occurring in early and middle Tertiary beds in New Zealand. Suter's records of *Nerinea* from the Tertiary (cf. *N.Z. Geol. Surv. Pal. Bull. No. 8*, p. 95; "*Nerinea* n. sp." from Chatton) refer to shells of this kind, and several undescribed species are known.

Genus **Triphora** Blainville, 1828 [P. 254]

That the complex covered by this name is polyphyletic has been admitted for long enough; as in the case of *Seila,* typical forms do not occur in New Zealand. There are many groups in Australasian Triphorids—and once again study of the apices seems to provide the best divisions—while the Neozelanic members fall into three series, *huttoni, lutea,* and the rest.

There is a well-marked austral group of Triphorids possessing a polygyrate apex with a sharp median carina crossed by numerous axial threads. *T. fasciata* Ten.-Woods, *granifera* Brazier, *innotabilis* Hedley, *tribulationis* Hedley, *infelix* Webster, and *fascelina* Suter all fall easily into this group, for which I propose *Notosinister* nov., with *T. fascelina* Suter as type. Odhner's record (1924, p. 28) of *T. tribulationis* Hedley, a north Queensland form, in New Zealand waters cannot be accepted. He mentions differences apparent even from the figure, and it is very probable that he was dealing with a fresh example of *T. fascelina* Suter.

T. huttoni Suter has a smooth several-whorled protoconch with a flattened dome-shaped top, and a strong medial groove on its later whorls; nodular sculpture is obsolete, and the shell has rather the appearance of a reversed "*Seila.*" It may stand as type of a new genus *Teretriphora,* and with it may be placed the South Australian and Tasmanian *T. gemmigens* Verco; Suter states [p. 257] that *T. angasi* Crosse and *T. kesteveni* Hedley are also closely allied species.

T. lutea Suter, with which *T. obliqua* May may perhaps be grouped, has a characteristic apex with a short blunt asymmetrical point and two heavy spiral keels on all its whorls. I name it as type of *Cautor* nov. *Teretriphora* and *Cautor* may in the meantime be regarded as subgenera of *Notosinister*.

I append a summary of the classification of New Zealand Cerithioids here proposed as follows.*—

Fam. CERITHIIDAE Fleming.

Genus *Zeacumantus* nov. Type: *Cerithidea subcarinata* Sow.
Zeacumantus subcarinatus (Sowerby, 1855).
—— *lutulentus* (Kiener, 1842).
[—— *perplexus*] (Marshall and Murdoch, 1919).
[—— *tirangiensis*] (Marwick, 1926).

Genus ZEBITTIUM nov. Type: *Cerithium exilis* Hutton.
Zebittium exile (Hutton, 1873).
—— *vitreum* (Suter, 1908).
(?) [——*marshalli*] (Cossmann, 1921) (=*minuta* Marshall).

Genus SPECULA nov. Type: *Cerithiopsis styliformis* Suter.
Subgen. SPECULA s. str.
Specula styliformis (Suter, 1908).
—— *marginata* (Suter, 1908).
—— *retifera* (Suter, 1908).
—— *canaliculata* (Suter, 1908).
(?) —— *dissimilis* (Suter, 1908) (*Seila*).
Subgen. MENDAX nov. Type: *Cerithiopsis trizonalis* Odhner.
Specula trizonalis (Odhner, 1924).
—— *stiria* (Webster, 1906).
Subgen. SOCIENNA nov. Type: *Cerithiopsis apicicostata* May.
Specula n. spp. not yet described.

Genus ALIPTA nov. Type: *Cerithiopsis crenistria* Suter.
Alipta crenistria (Suter, 1907).

Genus ZACLYS nov. Type: *Cerithiopsis sarissa* Murdoch.
Subgen. ZACLYS s. str.
Zaclys sarissa (Murdoch, 1905).
—— *subantarctica* (Suter, 1908).
—— *acies* (Suter, 1908).
[—— *aequicincta*] (Suter, 1917).
Subgen. MIOPILA nov. Type: *Cerithiella fidicula* Suter.
[*Zaclys fidicula*] (Suter, 1917).
(?) [—— *tricincta*] (Marshall, 1919).

Genus JOCULATOR Hedley. Type: *Cerithiopsis ridicula* Watson.
Joculator diremptus (Odhner, 1924).

Genus NOTOSEILA nov. Type: *Cerithium terebelloides* Hutton.
Notoseila terebelloides (Hutton, 1873).
(?) [—— *attenuissima*] (Marshall and Murdoch, 1920).

Genus HEBESEILA nov. Type: *Seila bulbosa* Suter.
Hebeseila bulbosa (Suter, 1908).
(?) —— *chathamensis* (Suter, 1908) (= *cochleata* Suter).
(?) [—— *huttoni*] (Suter, 1915).

Genus ATAXOCERITHIUM Tate. Type: *Cerithium serotinum* Adams.
Ataxocerithium huttoni (Cossmann, 1895) (= *invaricosum* Odhner).
[—— *robustum*] Finlay, 1924 (=*quadricingulatum* Finlay).
[—— *pyramidale*] Finlay, 1924 (=*nodicingulatum* Finlay).
[—— *tricingulatum*] Marwick, 1924.

*Add to this also the new genus *Batillona* Finlay, proposed elsewhere in this volume for three more New Zealand Tertiary species of this family.

Genus TAXONIA nov. Type: *Ataxocerithium suteri* Marwick.
Taxonia suteri (Marwick, 1924).
Genus ZEFALLACIA nov. Type: *Fastigiella australis* Suter.
Zefallacia australis (Suter, 1919).

Fam. TRIPHORIDAE Jousseaume.

Genus NOTOSINISTER nov. Type: *Triphora fascelina* Suter.
Subgen. NOTOSINISTER s. str.
Notosinister fascelina (Suter, 1908).
—— *infelix* (Webster, 1906).
(?) [—— *aoteaensis*] (Marshall and Murdoch, 1920).
(?) —— *ampulla* (Hedley, 1902) (?).
Subgen. TERETRIPHORA nov. Type: *Triphora huttoni* Suter.
Notosinister huttoni (Suter, 1908).
Subgen. CAUTOR nov. Type: *Triphora lutea* Suter.
Notosinister lutea (Suter, 1908).

Incertae sedis: *Cerithium inaequicostatum* Wilckens (*N.Z.G.S. Pal. Bull. No. 9*, p. 8, 1922); this Cretaceous species is based on a mere fragment, and might equally well be referred to the Scalidae.

Bittium oamaruticum Bartrum (*Trans. N.Z. Inst.*, vol. 51, p. 96, 1919) belongs to my genus *Notacirsa*, and the name is therefore invalidated by the prior *N. oamarutica* (Suter), the genotype; the species, founded on a single worn and broken shell, is too obscure to be worth renaming, and may be allowed to lapse.

Genus **Serpulorbis** Sasso, 1827 [P. 259]

This is better replaced by *Vermicularia* Lamarck, 1799, which is used by both Hedley and May for *sipho* Lamarck and allied forms. Marshall and Murdoch have described the "Miocene" form as *Vermicularia ophioides* (*Trans. N.Z. Inst.*, vol. 53, p. 80, 1921), and Marwick (*l.c.*, vol. 56, p. 312, 1926) has described a still earlier ancestor as *Serpulorbis lornensis*.

Genus **Siphonium** Mörch, 1859 [P. 260]

This genus name is preoccupied by Browne (*Hist. Jamaica*, ed. 2, p. 396, 1789), and as *Stoa* is not available for the Neozelanic species, I propose the new genus name *Novastoa*, naming the Neozelanic species *Siphonium lamellosum* Hutton as type. The nuclear characters in this family (or families) show well-marked differences, and—when available—provide the best means of classification.

The name "*Siphonium planatum* Suter" appears in many of Suter's lists of Tertiary fossils, but considerable difficulty was experienced in tracing the name. The place of its introduction is nowhere referred to by Suter, and I had come to the conclusion that it was either a *nomen nudum*, or a substitute name, on some ground or other, for Hutton's *lamellosum*, when I dropped across the description of it and another species (which has been totally neglected, see the notes on Trophons, later) in *Rec. Cant. Mus.*, vol. 2, p. 57, 1913. It is a circularly involute adherent-planorbiform species, described from two examples from Kapiti Island; both are now in the Canterbury Museum. The species may be referred temporarily to *Vermicularia*, and not *Novastoa*, and all records of it from the "Miocene" would

be better referred to Marshall and Murdoch's *V. ophioides,* till the group as a whole is revised.

Stephopoma nucleogranosum Verco, 1904 [P. 262]

It is doubtful whether Neozelanic specimens are really identical with South Australian ones; in these variable shells the only safe guide is the apex, and there seem to be a series of these "nucleogranose" and "nucleocostate" forms. There is an Upper Pliocene ancestor to the New Zealand species found in the Castlecliff beds. These shells are not well placed in *Stephopoma,* the type of which is the Neozolanic *rosea* Q. & G., so I provide for them the group name *Lilax* nov., naming *S. nucleogranosum* Verco as type.

Siliquaria cumingi Moerch, 1860 [P. 263]

Omit this. Suter himself said that he was "inclined to consider the specimen in the Canterbury Museum as a variety of the next species" (*weldii* Ten.-Woods). I have seen the specimen and concur.

A Tertiary species has been described by Marwick (*Trans. N.Z. Inst.,* vol. 56, p. 313, 1926) as *Siliquaria senex.*

Caecum digitulum Hedley, 1904 [P. 265]

Odhner has described a new species (1924, p. 29) from 35 fathoms, Colville Channel, as *Caecum suteri,* remarking, "This may be the same species as Suter (1913) mentions and (1915) figures under the name of *Caecum digitulum* Hedley, and which differs from Hedley's type in its less rapid tapering, according to a remark made by Iredale and quoted by Suter (*l.c.,* p. 265)." Odhner seems to have the impression that *digitulum* is an Australian species, whereas it comes from Lyall Bay. The rapidity of its taper is rather variable, and examination of many topotypes of both Hedley's and Odhner's species shows that the Lyall Bay and Hauraki Gulf forms are the same; Odhner's name will fall as a synonym of *digitulum.*

Genus **Turritella** Lamk., 1799 [P. 265]

This is in great confusion, specifically as regards the fossils, and generically as regards all the New Zealand representatives. Suter's descriptions of the Recent species contain many errors, especially concerning the apices and comparisons with exotic forms; his note on *T. tasmanica* Reeve (in the remarks on *T. fulminata* Hutton) has been corrected by Iredale (1924, p. 250). The latter writer has recently separated several genera for the Australian species, but many other groups can be distinguished. The austral genera at present recognised are as follows:—

Colpospira Donald, 1900; for *T. runcinata* Watson (= *accisa* Watson). Includes *sinuata* Reeve, *cordismei* Watson (which Iredale says is either the southern stage of *sinuata,* or identical with *runcinata*), and the Balcombian *platyspira* Ten.-Woods. Closely allied to these in style of apex and sinus, but uniformly differing in general facies (unpolished, more solid test, with perfectly straight instead of lightly concave spire), more rugged sculpture, tending to develop three strong keels (the middle one weakest and frequently slightly beaded), and deeply-cut suture, is a mostly Eocene group containing the Australian *aldingae* Tate (which Suter at one time identified from

New Zealand, but which Marwick has rejected) (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 328, 1924), *conspicabilis* Tate, *tristira* Tate, and the New Zealand *rudis* Marshall (*Trans. N.Z. Inst.*, vol. 51, p. 227, 1919) *waihaoensis* Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 328, 1924), and *tophina* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 313, 1926). For these is proposed the new genus *Spirocolpus*, with *T. waihaoensis* Marw. as type. The Australian shells have a slightly different appearance from the New Zealand forms here placed, and may later require separation.

Platycolpus Donald, 1900; for *T. quadrata* Donald. Includes *Colpospira guillaumei* Iredale. The latter author was at first of the opinion that *Platycolpus* merited only subgeneric status under *Colpospira* (1924, p. 247), but later ranked it as a genus (1925, p. 266). This is quite necessary, the protoconch and build of shell differing altogether from *Colpospira*, the deep sinus and rather weak sculpture being the only points in common.

Ctenocolpus Iredale, 1925; for *T. australis* Lamk. Includes the varietal form *C. australis diffidens* Iredale (1925, p. 267), and the fossil *T. pagodula* Tate, and *T. warburtoni* Tate. The latter superficially resembles some beaded specimens of *Spirocolpus rudis* (Marshall), but the essential details of apex and sinus place them in different groups.

Gazameda Iredale, 1924; for *T. gunnii* Reeve. Includes *tasmanica* Reeve (= *subsquamosa* Dkr.), while *clathrata* Kiener (see nomenclatural note elsewhere in this volume) and the fossil *acricula* Tate are, from the apical features, more or less closely allied, though representing diverse styles of sculpture and development. The group is quite peculiar in the large, obtuse, glossy, and almost Scaphelloid protoconch, as also, as Iredale notes, in viviparous habits. Iredale mentions that fossils labelled *T. murrayana* Tate showed lamellose sculpture as in the *oxyacris* form of *tasmanica* (1924, p. 250), but his specimens were evidently wrongly labelled, for *murrayana* shows no features of resemblance to *Gazameda*. This sublamellose ornament is occasionally seen also in the New Zealand *T. abscisa* Suter, but here again the affinity is purely superficial.

Glyptozaria Iredale, 1924; for *T. opulenta* Hedley. Includes the Balcombian *T. transenna* Ten.-Woods; widely different in facies from all the foregoing groups

Not a single New Zealand shell can be easily referred to any of the Australian genera, and it is necessary to create new names for the three main groups into which they fall. The largest group is typified by *T. vittata* Hutton, 1873 (= *carlottae* Watson), which may be named as type of a new genus *Zeacolpus*. With it can be associated the Recent *T. fulminata* Hutton and *pagoda* Reeve (which, though constant in habit, are both recognisably bathymetric or regional forms of *vittata*), and the Tertiary *lornensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 313, 1926), *albolapis* Finlay (*Proc. Mal. Soc.*, vol. 16, p. 101, 1924; new name for *concava* Hutton, preoccupied), *abscisa* Suter, perhaps *semiconcava* Suter, and many new species. *Zeacolpus* has a rather flattened apex of about one whorl, often developing a keel towards the end; the sculpture starts with two strong cords on the lower half, the upper stronger; two subequal

finer cords are soon developed above them, and there is a tendency for one or two of the spirals to become keels on later whorls; spire outline interrupted posteriorly by deep sutures, much less so anteriorly.

Also with a paucispiral apex, but with a different type of sculpture is *Stiracolpus* new genus, proposed for *T. symmetrica* Hutton, 1873; with which may be grouped the Recent *chordata* Suter (probably only a freak variant of the type species), and the fossil *waikopiroensis* Suter (*N.Z.G.S. Pal. Bull. No. 5,* p. 8, 1917), *kanieriensis* Harris (*Cat. Tert. Moll. B.M.*, Pt. 1, p. 241, 1897), and possibly the Australian Recent *T. godeffroyana* Donald, *atkinsoni* Tate and May, and *smithiana* Donald; many new Tertiary species are known to me. The apex of this group is one-whorled, without a keel, the sculpture starting with three subequal spirals, the median quickly becoming a little stronger; these three cords usually remain far the strongest, with not many interstitial riblets; the older Tertiary species have the lower two cords close and distant from the upper one, the later species tend to have the cords equally distributed.

The third group is represented by the common *T. rosea* Q. & G., which may be put forward as type of a new genus *Maoricolpus;* under this may also be ranged the Tertiary *cavershamensis* Harris (1897, p. 242) and many new species, and the Australian Tertiary *T. murrayana* Tate. The protoconch is polygyrate, papillate, and apparently sinusigeroid, the three to four tiny whorls being of distinctly smaller diameter than the following shell whorls, and thus noticeably projecting from them; the initial sculpture is of three ribs, the median strongest, the uppermost weakest; fine threads are intercalated on later whorls, which are relatively narrower between sutures than in the other groups, and tend to be concave; spire outlines straight, sutures very inconspicuous at all stages. *T. difficilis* Suter, I have noted elsewhere in this volume as preoccupied, but apparently inseparable from *rosea.*

The Cretaceous *Turritella solitaria* Wilck. (*N.Z.G.S. Pal. Bull. No. 9,* p. 35, 1922) cannot yet be located; its apex is unknown.

Turritella carlottae Watson, 1881 [P. 266]

Odhner (1924, p. 30) has correctly resumed the use of Hutton's specific name *vittata* for this species; Murdoch and Suter (*Trans. N.Z. Inst.*, vol. 38, p. 292, 1906) dropped the name on account of supposed preoccupation by Lamarck, but that was an error, as has already been pointed out by E. A. Smith (*Brit. Antarc. "Terra Nova" Exped.*, vol. 2, No. 4, p. 80, 1915), who also records that the species grows to a length of 85 mm.

Mathilda neozelanica Suter, 1908 [P. 273]

Suter has compared this species with the Australian *M. decorata* Hedley, but commented on the difference in apex. The resemblance between the two shells is curious but entirely superficial, *decorata* having a smooth bulbous embryo, abruptly set at right angles to the shell, while *neozelanica* has a heavily spirally keeled protoconch, marked off by a slight varix, but otherwise in the plane of the whorls, only the tip being slightly immersed (Suter's figure much exaggerates this feature). An exactly similar type of apex, differing only in

more numerous keels is shown by *Aclis succincta* [p. 327], described by Suter in the same year but not recognized as a near relation. In the absence of soft parts and operculum, it is difficult to know where to locate these shells, but the new genus *Brookesena* here proposed for them (with *M. neozelanica* Suter as type) may be provisionally located in *Rissoidae*, near *Lironoba*. The genus is named after A. E. Brookes of Matamata, a well-known conchologist.

Family **Struthiolariidae** Fischer [P. 273]

Dr. Marwick has recently published (*Trans. N.Z. Inst.*, vol. 55, p. 161-190, 1924) a comprehensive monograph of "The Struthiolariidae," this family being represented by 28 Neozelanic species in the Tertiary and Recent faunas. Since then, three further Tertiary species have been described: *S. prior* Finlay (*Trans. N.Z. Inst.*, vol. 56, p. 228, 1926), *S. nana*, and *S. praenuntia* Marwick (*l.c.*, p. 318). Marwick creates one new genus, *Monalaria* (p. 163), for *Struthiolaria tuberculata concinna* Suter; this is entirely a very early Tertiary group, of few species. Apart from this, all the New Zealand forms are included in *Struthiolaria* (*Struthiolariopsis similis* Wilckens, 1922, p. 17, a Cretaceous form, is shown to be not referable to the family), three groups being outlined but not named. They should have been, however; one of them at all events is quite distinct, for the following reasons: Marwick figures the curious apex of *Struthiolaria vermis* Mart. (p. 163), and remarks, "Well preserved examples of the Recent and Pliocene *S. papulosa* and *S. vermis* show, in most cases, a small, almost planorbid apex of one or two smooth volutions. This has always been considered as the protoconch; but a surprising condition was revealed by some specimens of *S. vermis* from the Wanganuian Pliocene. In these the protoconch is a smooth, bulbous, capuliform structure, with its long axis at right angles to that of the shell. That this is the true protoconch is shown by the appearance of the same feature on specimens of *S. convexa* n.sp. . . . In withdrawing from the embryonic shell, the animal constructs numerous septa, so that, the hollow bulb being easily broken off, a planorbid apex is the result. It is probable that this type of protoconch prevails throughout the genus, for the smooth planorbid tip, generally seen in all well-preserved shells, is followed by a convex striated conch-whorl similar to that following the deviated protoconch of the examples cited above." Later (p. 167), he figures the apex of *S. papulosa* Mart., and examination of any perfect specimen will show that this small, glossy, planorbid embryo is certainly the true apex, and has not resulted from fracture. That the apex of *S. convexa* Marwick resembles that of *S. vermis* Mart., is to be expected, as both species belong to the same lineage. The protoconch of *S. subspinosa* Marwick, on the other hand, is identical with that of its lineal descendant, *S. papulosa*. This difference in the embryos is the best and surest evidence of the presence in New Zealand Tertiary beds of two radically different though superficially similar stocks of *Struthiolaria**

*In a later publication (*Trans. N.Z. Inst.*, vol. 56, p. 266, 1926) Marwick has himself made the statement, "The shape of the nucleus is a valuable guide in grouping related shells," and has adopted this as a principle in classifying the Volutes.

(comparison of the radulae of the two Recent species would be very interesting, and one may predict that it would but confirm the separation here made on apical features). Dr. Marwick has noted them as different groups, but, misinterpreting the observed embryonic differences, was not able to separate them with certainty from shell features alone. But I would now recognise them as distinct genera, so that *Pelicaria* Gray, 1857 (*Guide Syst. Distrib. Moll. B.M.*, p. 97) (type: *S. vernis* (*sic*) = *Buccinum vermis* Mart., *vide* Marwick, p. 170) returns to use as a generic name for the *vermis* lineage; forms of this group which converge towards *Struthiolaria* s.str. in shell formation are placeable easily and with certainty if the apex is examined. For the *Struthiolaria callosa* Marwick group I now provide the new subgenus *Callusaria;* it is probably not so distinct as the *vermis* line is from *Struthiolaria* s.str., but the four species included by Marwick form a rather compact assemblage, for which a group name is desirable.

Xenophora corrugata (Reeve, 1842) [P. 278]

In this case Suter's name of *X. neozelanica* must be used, as Reeve's species is quite distinct. The misunderstanding arose through the extreme range given to Reeve's shell, "Indian Ocean, Japan, etc." Mr. Iredale informs me that when the type of Reeve's species is examined, the Neozelanic shell is easily separable, and when Hedley suggested their identity, he referred only to Fischer's conception of Reeve's species.

The generic name must be *Onustus* Humphrey, as maintained by Moerch many years ago, the description and bibliographical reference enabling the exact recognition of Humphrey's genus.

I have described an early Tertiary ancestor to the Recent species (*Trans. N.Z. Inst.*, vol. 56, p. 228, 1926) as *Onustus prognatus,* showing that the *neozelanica* style of shell has lived in this locality for a long time.

Fam. **Hipponicidae** Fischer [P. 281]

The three species recorded from New Zealand, *Hipponyx hexagonus* Suter, *Pilaeopsis radiatus* Hutton, and *H. antiquatus* Linné have been discussed by Powell in a "Review of the Recent and Fossil New Zealand Species ascribed to *Hipponyx*" (*N.Z. Journ. Sci. and Tech.*, vol. 6, nos. 5 & 6, p. 282, 1924) and by Finlay (*Proc. Mal. Soc.*, vol. 16, pt. 2, p. 100, 1924) with the result that the Recent form disappears as a synonym of *Gadinia nivea* Hutton (q.v.), while, of the fossil shells, *radiatus* proves to be a *Crepidula,* its name being an available substitute for the indeterminable *C. striata* (Hutton), and *antiquatus* is rejected, the sole record for the family being now *Hipponyx* species from Kaawa Creek.

Fam. **Calyptraeidae** Broderip [P. 282]

Smith (*Brit. Antarc. "Tera Nova" Exped.*, vol. 2, no. 4, p. 83, 1915) has recorded the Australian *calyptraeformis* from New Zealand, but Peile, from examination of the radula, has distinguished the New Zealand shell as a new species, *terraenovae (Proc. Mal. Soc.*, vol. 16, pt. 1, p. 21, 1924). This species is common in the Cookian Province in depths of from 20–60 fathoms, where it seems to replace

S. novaezelandiae. In Peile's description, differential features were based mainly on the radula and he did not stress the chief conchological characters; in consequence his shell is not readily recognisable to those who have not abundant material. *Terraenovae* is easily distinguished from *novaezelandiae* by the absence of an open umbilicus, only a mere chink being present; its shell is more circular and has a less excentric nucleus, but it is proved to be a *Sigapatella* by the spiral grooves at the close of the protoconch. Peile does not mention the spiral ornament; this is not always present in either species, but when it is it serves as a ready means of identification; *novaezelandiae* has four coarse irregular low spiral cords (interstices about as wide), while *terraenovae* has numerous flat ribs (with sublinear grooves between) descending more or less rapidly to the margins. Since Peile did not illustrate his shell, figures are here appended of a specimen in the Finlay collection from 40 fathoms near Cuvier Island (Figs. 1, 2). The species does not occur in other provinces, *tenuis* and *novaezelandiae* occurring down to 60 fathoms in Forsterian localities from which dredgings have been seen.

Very distinct Tertiary members of *Sigapatella* are *Calyptraea maccoyi* Suter (*N.Z. Geol. Surv. Pal. Bull. No. 5,* p. 9, 1917), and its direct ancestor *C. vertex* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 314, 1926); these also have peculiar radial ornament. *Calyptraea solitaria* Wilckens (*N.Z.G.S. Pal. Bull. No. 9,* p. 6, 1922) possibly belongs to *Sigapatella,* but this Cretaceous species is worthless, being known to science by one internal cast.

It is probable that there are many forms of the "*scutum*" series, for Smith separated the Australian shells from the Neozelanic ones, calling the former *hedleyi,* the latter being *tenuis* Gray. Though never explicitly stated, the types of Smith's *hedleyi* were South Australian shells sent by Verco (information from T. Iredale). Shells of this style, tentatively named *hedleyi,* from Twofold Bay, are much higher than Verco's specimens. The radulae of these shells and the radula of the Neozelanic *tenuis* differ from that of the *Sigapatella* series. The central tooth approaches much more closely to that of *chinensis* Linné, the type of *Calyptraea* Lamarck, 1799 (a name which must give way to *Galerus* Humphrey of the *Museum Calonnianum,* p. 5, 1797, founded on the same type), and the shells are conchologically easily separable, so that for this group I propose *Zegalerus* nov., naming *Clypeola tenuis* Gray 1867 as type.

Here, too, may be located in the meantime *Calyptraea alta* (Hutton) (*Trans. N.Z. Inst.*, vol. 17, p. 329, 1885), based on a Pliocene fossil. This still lives as a Recent form in the Chatham Islands, but the Cape Maria van Diemen shells referred here are distinct. Hutton described the species as *Trochita alta,* but Conrad had, thirty years previously, employed the same name (*Proc. Acad. Nat. Sci. Philad.*, p. 259, pl. 15, fig. 3, Jan. 1855, where a reference is given to Waile's Geol. Miss., p. 287, pl. 15, fig. 3, a, b, 1854, which has not been seen). I have to thank Mr. Iredale for these references, and I now provide for the Petane species originally described by Hutton the new name *Zegalerus crater.* As a species, this is not always readily separable from *tenuis* Gray; adults are easily distinguished by their much larger size and tall conical form, but juveniles of the two forms are

often deceptively alike. Careful scrutiny, however, always allows of separation, for *crater* has a much more solid shell of very coarse texture, the sides are almost straight, the whorls being more concealed than in *tenuis,* the growth lines appear from above rather as concentric circles than as logarithmic spirals, there is generally no tendency for the last whorl to flatten out (as is almost always the case in *tenuis*), and there is no hollow axis. The last feature, which is so conspicuous in true *tenuis,* is perhaps the safest for quick separation. Even young shells of *crater* can be distinguished from *tenuis* by the character and set of the embryonic whorls, which project laterally and obliquely, and have the inner whorl somewhat inrolled and hidden by the outer; the protoconch of *tenuis* rises in a more regular spiral, and juts more vertically, the inner whorl generally rising above the outer and not at all obscured by it. E. A. Smith's figures of Gray's type of *tenuis (Brit. Antarct. " Terra Nova " Exped.,* Moll., pt. 1; pl. 1, figs. 20-22, 1915) are a little puzzling, the side-view showing a shell quite like *crater,* though the internal aspect is that of what I am taking for *tenuis*; however, the actual size given shows that the type was a juvenile shell, and such are sometimes found with considerable altitude. The whole of Smith's descriptions and comparisons apply to the common South Island littoral and deep-water shell rather than to the very rare Moriorian and Pliocene *crater.*

Genus **Crepidula** Lamarck, 1799 [P. 286]

This genus name is later than, and exactly equivalent to, *Crypta* of the *Museum Calonnianum,* p. 4, 1797, both being based on the American *Patella fornicata* L. It is almost certain that the radula will show good differences in Crepidulid shells, but the Neozelanic group centering in *costata* Sow. is a very peculiar one, being confined to New Zealand, and having many fossil antecedent forms in the same country. Curiously enough, Suter mentioned as equivalent *aculeata* Gmelin, which is at present given a world-wide range, showing very little variation; it, however, has a notched septum, and otherwise differs considerably. In view of these facts I propose to erect a new genus *Maoricrypta,* naming *C. costata* Sow. as type

Another group is represented by the series of slipper limpets that live inside dead shells; this is an extremely interesting one and needs detailed study. Whereas the apex in the *costata* series is smooth and glossy, passing directly into the crude corrugations of the adult sculpture, the *monoxyla* line has developed an intervening brephic stage which forms a large slightly raised ellipsoidal cap (with the flatly-coiled smooth embryo at one of the foci), ornamented all over with fine threads radiating from the embryo. The " Miocene " ancestor of *monoxyla* has the same feature, only the threads are fewer and wider; this stage has evidently developed long since, and never appears in the costate forms; I therefore emphasize the distinction of the parasitic group by providing *Zeacrypta* nov. for *monoxyla* Lesson at present allowing it subgeneric rank under *Maoricrypta.* The reference of the high, nonparasitic forms to *monoxyla* is doubtful; they seem quite distinct specifically, possibly generically, and may indeed be degenerate forms of *Maoricrypta.*

One may recommend investigation of this problem and I suggest that only the flattened parasitic forms are true *Zeacrypta monoxyla.*

Maoricrypta has numerous fossil members, *haliotoidea* Marwick (*Trans. N.Z. Inst*, vol. 56, p. 318, 1926), *radiata* Hutton (see note on *Hipponyx*), *densistriata* Suter (*N.Z.G.S. Pal. Bull. No. 5,* p. 10, 1917), *wilckensi* Finlay (= *incurva* Zittel, preoccupied) (*Proc. Mal. Soc.*, vol. 16, p. 101, 1924), and *hochstetteriana* Wilckens (*N.Z.G.S. Pal. Bull. No. 9,* p. 5, 1922), may all be cited in this connection; the last named carries the line back to the Upper Senonian.

Genus **Natica** Scopoli, 1777 [P. 288]

None of the known Neozelanic members of the family fall into the genus *Natica,* which has a spirally multisulcate calcareous operculum.

Natica australis Hutton was proposed as a *Lunatia,* and is now referred to Bolten's genus *Cochlis,* so that a new name is not necessary, unless there be another species *australis* in *Cochlis,* or another *L. australis* be unearthed. At present my substitute, *Natica maoria* (*Proc. Mal. Soc.*, vol. 16, pt. 2, p. 101, 1924), cannot be used, and the species name will revert to *australis* (Hutton).

Natica zelandica Q. and G. is also to be referred to the genus *Cochlis.* Dr. Marwick has published an account of the Tertiary and Recent Naticidae and Naricidae of New Zealand (*Trans. N.Z. Inst.*, vol. 55, pp. 545-579, 1924), and makes no mention of *Cochlis,* but till more is known of the opercula of the fossil species, all his species of *Natica* would be better classed as *Cochlis.** In that paper he has added two species to the Recent fauna, *Natica denticulifera* Marwick (p. 552) (from unknown locality, type from the Pliocene), and *Uber* (*Euspira*) *barrierensis* Marwick (p. 571) (from off Great Barrier Island, 110 fathoms, while he places Suter's two species of *Ampullina* —*undulata* (Hutton) (see nomenclatural note and new substitute name elsewhere this volume) and *venusta* (Suter)—in his new genus *Globisinum,* proposed for *Sigaretus* (?) *drewi* Murdoch (pp. 575, 576). To the species included here by Marwick must be added *G. crassiliratum* Finlay (*Trans. N.Z. Inst.* vol. 56, p. 230, 1926). The other new group names proposed by Marwick in this account are:— *Carinacca* (for *Ampullina waihaoensis* Suter), *Magnatica* (for *Polinices planispirus* Suter), and *Sulconacca* (for *S. vaughani* Marwick; see note under *Ampullina apora,* below); the genotypes of these three groups are all lower Tertiary shells. Besides these, the genera *Neverita* Risso and *Amauropsella* Chelot are added to the Tertiary fauna. I have since then added three further Tertiary species of *Magnatica* (*Trans. N.Z. Inst.*, vol. 56, pp. 228, 229, 1926) and proposed a new subgenus *Spelaenacca* for one of them (*M. altior*).

Powell has (elsewhere in this volume) added still another Recent species of *Cochlis* (from Whangaroa) to the New Zealand fauna.

*Since the above was written, I have recovered from two fossil species, *N. praeconsors* Finlay and *N. notocenica* Finlay, opercula of the true *Cochlis* style.

Genus **Polinices** Montfort, 1810 [P. 290]

This has been displaced by *Uber* Humphrey 1797, of the *Museum Calonnianum,* in a recent study of the group by Hedley *(Rec. Austr. Mus.*, vol. 14, No. 3, p. 154, 1924). The species *Lunatia vitrea* Hutton is very probably distinct from Watson's *Natica amphiala,* the location and station being widely separated; this is discussed by Marwick (*Trans. N.Z. Inst.*, vol. 55, p. 570, 1924) and the usage of *vitreus* Hutton may, at all events, be recommended for Forsterian shells. Marwick has used *Uber,* but seems to be dubious that the distinction between the horny and shelly operculate groups is definite. Study of the radulae of the Recent species shows valid differences.

One further Tertiary species of *Uber* has to be added to Marwick's list, *Uber laxus* Finlay (*l.c.*, vol. 56, p. 229, 1926), while Wilckens (1922, pp. 6, 7) has described two Cretaceous forms *selwyniana* and *ingrata.*

Ampullina apora (Watson, 1881). [P. 293]

The Neozelanic shell referred to this Aru Island species of Watson may be a species of *Friginatica.* That genus has been recorded (in the form of *F. pisum* Hedley) from Macquarie Island (Hedley, 1916, p. 52), but Hedley's species does not, from the figure, seem congeneric with his genotype; a true fossil member is, however, known in *Lunatia suturalis* Hutton (*Trans. N.Z. Inst.*, vol. 9, p. 597, 1877). Marwick has proposed a new genus *Sulconacca* for *S. vaughani* Marwick, a close relative of this species, so that *Sulconacca* appears to be an absolute synonym of *Friginatica.* The characters on which *Sulconacca* was founded are all present in *Friginatica,* while the Australian Tertiary *F. polita* Ten.-Woods *(P.R.S. Tas.* for 1875, p. 23) is with difficulty separable even as a species from *S. vaughani* Marwick*, and (according to Hedley, 1916, p. 51) even from the genotype of *Friginatica, N. beddomei* Johnston *(Proc. Roy. Soc. Tas.* for 1884, p. 222).

The "Family Naricidae" used by Marwick must give way to Merriidae, while reference to the early Tertiary European *Micreschara* and its section *Macromphalina* would be obviated by the use of Hedley's *Naricava* (*P.L.S.N.S.W.*, vol. 38, p. 294, 1913), proposed for *Adeorbis angasi* A. Ad., to which *Micreschara huttoni* Marwick is very similar even specifically.

Genus **Lamellaria** Montagu, 1815. [P. 293]

To *L. cerebroides* Hutton and *L. ophione* Gray must now be added *Lamellaria verrucosa* Odhner (1924, p. 31), described from Auckland Island.

Genus **Trichotropis** Broderip and Sowerby, 1829. [P. 296]

This genus is based on an Arctic species with only a vague resemblance to the Neozelanic species, which Hedley suggested might be referred to *Sirius,* but a new genus would meet the case better, *S. badius* T.-W., the type of *Sirius,* being a much smaller shell, with different style of ornament and aperture. I therefore propose the new generic name *Trichosirius,* naming *Trichotropis inornata* Hutton as type.

*Dr. Marwick, having seen specimens, concurs in this view.

Iredale has indicated (1924, p. 251) that if the grouping be continued the family name must be *Lippistidae* on the score of priority, and he has also pointed out the confusion existing in connection with the species and specific names of *Lippistes*. The South African type has a similar appearance to the Neozelanic shell, but agrees less with the intervening Australian series. As Tertiary forms related to the Neozelanic type have been found within late years (*L. perornatus* Marshall and Murdoch, *Trans. N.Z. Inst.*, vol. 54, p. 121, 1923; and *L. pehuensis* Marwick, *Trans. N.Z. Inst.*, vol. 56, p. 319, 1926), there is probably only indirect relationship between the several Recent stocks, which perhaps sprang from a common ancestral dweller on the shores of Gondwanaland. One may, therefore, introduce a new generic name *Zelippistes*, naming *Separatista benhami* Suter as type.

Genus **Recluzia** Petit, 1863.

Powell has added this to the New Zealand fauna by recording *Recluzia lutea* (Bennett) from Great Barrier Island (*N.Z. Journ. Sci. and Tech.*, vol. nos. 5 and 6, p. 285, 1924).

Trivia australis (Lamarck, 1822). [P. 301]

Iredale has pointed out that the Lamarckian name is preoccupied and no substitutes are available, and has therefore described the Australian shell as a new species under the name *Triviella merces* (1924, p. 257). Upon examination it is found that Neozelanic specimens differ, so also require description as a distinct form.

Triviella memorata n. sp. (Fig. 73.)

Shell globose and inflated, high but not elongate. Milk white, with two central large red-brown patches meeting across dorsal groove, a small anterior and one or two posterior patches, ends of outer lip same colour. Whole surface with weak transverse ribs, meeting at a more or less faint dorsal groove, continued everywhere into interior except for a small smooth space at anterior canal. Sides curved, not even approximately parallel. Outer lip not much projecting beyond spire. Other details as in *T. merces* Iredale.

Length, 13.5 mm.; height, 8.5 mm.; width, 9.5 mm.

Locality,—Ahipara Bay, near Auckland.

Close to *T. merces* (a Sydney specimen of which is here figured for comparison—Fig. 74), but shorter, higher, and more globose, with larger colour-patches, and less produced outer lip. Not very close to any of the three Tertiary Neozelanic species, *zelandica* Kirk (*Trans. N.Z. Inst.*, vol. 14, p. 409, 1882), *pinguior* Marwick (*l.c.*, vol. 56, p. 314, 1920), or "*avellanoides* Tate" (*vide* Marshall, *Trans. N.Z. Inst.*, vol. 49, p. 461, 1917); the latter is of the same generic style, but the two former would be better referred at present to *Trivia*.

Genus **Erato** Risso, 1826.

Although living species are known from Australia and most other parts of the world, this genus is not yet represented in the Recent Neozelanic fauna, the nearest occurrence being *E. lachryma* Gray, recorded by Iredale from the Kermadecs (*Proc. Mal. Soc.*, vol. 9, p. 71, 1910). A Tertiary species, however, *E. neozelanica* Suter (*N.Z.*

G.S. Pal. Bull. No. 5, p. 12, 1917), has been known for some time, and has recently been redescribed and figured by Murdoch (*Trans. N.Z. Inst.,* vol. 55, p. 160, 1924). To this have now to be added several further species described lately: *antiqua* Marshall (*Trans. N.Z. Inst.,* vol., 51, p. 227, 1919), *vulcania* Marwick (*l.c.,* vol. 56, p. 314, 1926), and *senectus* Murdoch (*l.c.,* vol. 55, p. 160, 1924). The curious plaits running over the anterior part of the outer lip on to the base in the last-named species are evidently a specific character, as I have another specimen from Target Gully agreeing exactly in this respect with the previously unique type.

Family **Septidae.** [P. 302]

This name was amended to *Cymatiidae* by Iredale in his "Commentary," and some notes given on the classification of the group. Some further corrections may now be made in the species and group names.

Septa tritonis (Linné, 1758). [P. 304]

This is a very doubtful member of the fauna, and shells so called should be critically examined and compared with typical specimens. Smith (*Brit. Antarct. Exped.,* Moll., pt. 1, p. 84, 1915) has pointed out that a perfect apex dredged in 11-20 f. near North Cape differed in detail from that of true *tritonis.*

Septa rubicunda Perry, 1811 [P. 303]

Iredale advised the use of *Charonia lampas* (Linné, 1758), but informs me that, as in other cases of lumping, he has been compelled by study of more material to alter his decision. "When series of shells are studied, the variation is seen to be geographical as well as individual, and consequently races (or species) can be really determined. Thus, a dozen South African shells showed features of nodulation which differed from that seen in Australian specimens, though both series varied *inter se.* The few Kermadec specimens differ from a series of New South Wales shells, and the Neozelanic form is easily separable." (T. Iredale, *in litt.*)

I have recorded an Australian form, *euclia* Hedley, from off the Neozelanic coast (*Trans. N.Z. Inst.,* vol. 55, p. 462, 1924, but this proves different again, so that these Neozelanic forms are now described as new.

Charonia capax n. sp. (Fig. 67.)

Shell large and wide, with capacious aperture. Apex lost. Two strongly-noduled, broad spiral cords per whorl (9-10 nodules per whorl), and many variable narrow flattish riblets (interstices wider on shoulder, sublinear below); body-whorl with about nine strong cords, all with faint nodulation, 2-3 narrower weaker cords in interstices, canal with 10-12 cords. Colour pure white, with pale yellow-brown maculations on main cords, parts of shell suffused with a pinkish-brown tinge; inside of outer lip and lower part of columella glossy, greyish-brown, with occasional pale reddish-brown bars. Varices, about 150° apart, low, flattened, with little difference in level on either side. Spire a little shorter than aperture, sides straight; whorls with a submedian shoulder (slope about 45°, thence vertical);

sutures distinct, irregular but not undulating. Body-whorl considerably inflated, with an expanded outer lip which is thin and sharp, only slowly thickened inside, curving regularly, the wide and short canal hardly protruding beyond it. Pillar placed much to the left, considerably angularly excavated above the three or four weak basal plaits. A rather weak parietal tubercle distant from outer lip.

Height, 165 mm.; diameter, 90 mm.

Locality, off Otago Heads, in 20 fathoms.

Differs considerably from the Australian *rubicunda* in colour, higher shoulder, weaker and more numerous nodules, more excavated and sloping pillar, shorter and wider canal, much weaker parietal tubercle, expanded and regularly curved outer lip, not angled at shoulder, absence of teeth and chocolate-brown bars inside lip, and altogether larger and more inflated body-whorl.

Subsp. **euclioides** nov. (Fig. 68.)

In colour and general arrangement of sculpture similar to the species, but the whole ornament stronger; the nodules are smaller, higher, and more pronounced on all whorls, especially those on lower cord; cords on shoulder very much narrower, interstices 4-5 times as wide. Shell much thinner and taller, spire considerably higher than aperture, which is rather compressed, the outer lip (though broken) much less expanded. Parietal plait much stronger.

Height, 210 mm.; diameter, 90 mm.

Locality, off Otago Heads, in 40 fathoms.

Very similar to *euclia* Hedley, and recorded by me as such, but apparently of different colour, and with a taller, more compressed aperture and more excavated pillar; also it is evidently a derivative of *capax* nov., which differs considerably from the forms out of which *euclia* has sprung.

Cymatium parthenopeum (von Salis, 1790). [P. 305]

New Zealand specimens have a longer canal, a different outer lip, and a considerably smaller aperture than Australian shells, so that the use of Hutton's name *Triton acclivis* (*Cat. Mar. Moll.*, p. 13; plate fig. 8, 1873) may be counselled.

Cymatium exaratum (Reeve, 1844) and **Austrotriton parkinsonianum** (Perry, 1811). [pp. 306, 307]

Lack of comparative material at the present time prevents criticism of these species and their New Zealand records, though it may be noted that Powell has lately re-recorded them both (*N.Z. Journ. Sci. and Tech.*, vol. 6, nos. 5 and 6, p. 286, 1924). I present figures of actual New Zealand shells (*exaratum*, Figs. 83, 84; *parkinsonianum*, Fig. 85), but the few specimens I have seen do not show satisfactory differential characters from Australian shells, so that these two species may stand in the meantime. They and *Cymatium acclive* (Hutton) seem to be geologically quite recent immigrants to the New Zealand region; a species of *Austrotriton* (*maorium* Finlay) is common in the "Miocene," but the genus seems quite absent in the Pliocene. For a discussion of the New Zealand fossil species and

their relationships, with keys to genera and species, see Finlay, *Trans. N.Z. Inst.*, vol. 55, pp. 453-465, 1924.

Argobuccinum argus (Gmelin, 1791). [P. 309]

Argobuccinum is not valid at the place quoted by Suter, viz., Hermannsen, 1846, but dates only from Moerch, *Cat. Conch. Yoldi*, 1852, where it exactly equals *Priene* H. & A. Adams, 1858 (*Gen. Rec. Moll.*, vol. 2, p. 654), which name it must replace. I therefore propose the new name *Gondwanula*, naming *Ranella tumida* Dunker as type. The existing members of this group seem to be confined to shores of the continents that once formed "Gondwanaland," and the stock would thus seem to be of very early origin and South Tethyan distribution.

I have elsewhere added *Priene retiolum* Hedley to the Neozelanic fauna (*Trans. N.Z. Inst.*, vol. 55, p. 462, 1924). The generic location of *retiolum* is in *Fusitriton* Cossmann, and the Neozelanic shell requires a new specific name. A beautiful specimen has lately been obtained from off Otago Heads in 40 fathoms, and since this permits of more accurate comparison than was possible with the fragment recorded from Taieri Beach, and proves to be distinct, it is now described.

Fusitriton laudandum n. sp. (Fig. 65.)

Shell large, fusiform, thin and light. Colour whitish, marked with double yellow-brown bands on the spire-whorls. Apex lost. Sutures deep, spire a little higher than aperture and canal. Varices very weak and low, irregular, two or more to a whorl. Whole surface reticulated, four more-prominent double spiral cords per whorl, and about 19 axials, interstices about three times as wide in each case, so that there are square meshes with double nodules at each corner over the whole shell except base, axials rather abruptly fading out just below periphery; 16 spirals and 27 axials on last whorl. Aperture ovately pyriform, outer lip with a stronger varix than elsewhere, simple within; a channel posteriorly between outer lip and a low thick parietal plait; anteriorly a fairly long, straight, sloping canal. Inner lip smooth, distinctly limited. Pillar with a low blunt ridge at its base, above which it is deeply excavated.

Height, 100 mm.; diameter, 46 mm.

Locality,—Off Otago Heads in 40 fathoms.

The shell is smaller and the sculpture coarser than in *F. retiolum* (Hedley), which has 35 radials and 22 spirals on the last whorl of a shell measuring 130 mm. by 60 mm.

With this shell were dredged several living and very large specimens of *Gondwanula tumida* (Dkr.), the largest measuring 130 by 79 mm.; the maximum size given by Suter is 103 by 62 mm.

Argobuccinum australasia (Perry, 1811). [P. 310]

For this species Iredale has proposed the genus *Mayena*, and an investigation of the forms would yield much of interest. There appears to be variation associated with geographical distribution, but this is somewhat masked by individual variation. From southern Australia specimens with two rows of nodules on the last whorl are

commonly met with, the majority of the Sydney shells show *only one obsolete row, while from* Norfolk Island a large shell with numerous nodules has been seen. As the New Zealand shell appears to differ also, having a subobsolete lower keel, and many nodules on the peripheral keel (about 9 between varices in specimen figured), I supply the name *Mayena zelandica* for the shell from Tauranga (in the Finlay collection) here figured (Fig. 66); a general diagnosis of the species is given by Suter under *Argobuccinum australasia.* The dimensions of the figured type are 90 mm. by 52 mm.

In treating of the New Zealand fossil Cymatiidae, I noted the distinctness of one of the groups *(Trans. N.Z. Inst.*, vol. 55, p. 458, 1924), and I now refer *C. kaiparaense* Finlay and *C. sculpturatum* Finlay to *Mayena;* these specimens were compared with the Australian fossil *Triton intercostale* Tate, and this species is also a *Mayena.* Two others (*revolutum* Finlay and *transennum* Sut.) that were included in this group now turn out to belong, as I suggested, to *Semitriton;* the former has been described and figured also by Marwick *(l.c.,* vol. 56, p. 315, 1926). My *octoserratum (loc. cit.,* p. 459), which I compared with *quoyi* and its congeners, will be referable to *Cymatiella* Iredale (1924, p. 253).

Phalium labiatum (Perry, 1811). [P. 312]

Iredale is reviewing the Australian species of this group in a paper to appear shortly in the *Records of the Australian Museum.* As he is incorporating there some remarks on New Zealand forms I have sent him, and describing some as new species, a revision must be postponed until his paper has appeared. Mention need be made only of the new genus *Euspinacassis* Finlay *(Trans. N.Z. Inst.,* vol. 56, p. 230, 1926) created for three Tertiary New Zealand shells—*E. pollens* Finlay *(l.c.), Phalium grangei* Marwick *(l.c.,* p. 319), and *Cassis muricata* Hector *(vide* Suter, *N.Z.G.S. Pal. Bull.* No. 3, p. 12, 1915)—somewhat resembling *Echinophoria* Sacco. In a recent paper on the "Cassididae of Western America" by Schenck *(Bull. Depart. Geol. Sci.,* vol. 16, No. 4, p. 72, 1926), *Echinophoria* (with type *Cassis intermedia* Brocchi) is placed as a section of *Bezoardica* with the definition, "Callus nearly smooth; nodosities almost covering whorl." *Euspinacassis* has a ridged callus, and appears, as one would expect, genetically related to the austral *Casmaria* (*pyrum* Lk., etc.) rather than to *areola* Gm., the type of *Bezoardica.*

Tonna variegata (Lamarck, 1822). [P. 314]

Hedley has separated New Zealand shells from the Australian *variegata* Lamk., and supplied for them the name *Tonna haurakiensis* (*Rec. Austr. Mus.*, vol. 12, No. 11, p. 331, 1919). Wilckens (*N.Z.G.S. Pal. Bull. No.* 9, p. 18, 1922) has proposed a new genus *Protodolium* for *Neritopsis speighti* Trechmann (Geol. Mag., n.s., dec. 6, vol. 4, p. 300), an Upper Senonian fossil, and referred it to the *Tonnidae,* as an ancestor of *Dolium* (i.e. *Tonna*).

Family **Architectonicidae** H. and A. Adams. [P. 315]

General notes on the few New Zealand species of this family may be brought together under this head.

Architectonica reevei (Hanley, 1862) appears to claim a place in the Neozelanic fauna, Powell having lately figured New Zealand specimens gathered at Mt. Maunganui, Bay of Plenty (Bucknill, p. 57, Pl. 8, fig. 19, 1924). Tertiary species are *aucklandica* (Marsh.) *(v.i.)*, *marwicki* Allan *(Trans. N.Z. Inst.*, vol. 56, p. 338, 1926) and *ngaparaensis* Suter (1917, p. 14); *inornata* Marshall *(Trans. N.Z. Inst.*, vol. 49, p. 452, 1917) I have made the subject of a nomenclatural note and the type of a new genus elsewhere in this volume.

Philippia Gray, 1847 should be given generic rank. *P. lutea* (Lamarck, 1822) seems also to have several authentic New Zealand records, and has also been figured from New Zealand specimens by Powell *(loc. cit.*, Pl. 8, fig. 20).

Heliacus variegatus (Gmelin, 1791) should probably be replaced by *H. stamineus* of the same author, if one may judge from Suter's description and figure; I have seen no adult New Zealand specimens. Apart from this rather doubtful record, the genus has no representatives in the Neozelanic fauna, though several Tertiary species have been described as such. *H. conicus* Marshall *(Trans. N.Z. Inst.*, vol. 49, p. 453, 1917) has already herein been made the type of *Conominolia* nov. and referred to the Umboniidae; I have advocated the dismissal of *imperfectus* Suter as an unrecognizable species *(Trans. N.Z. Inst.*, vol. 55, p. 506, 1924), certainly not a *Heliacus; aucklandicus* Marshall (*l.c.*, vol. 50, p. 263, 1918) is an *Architectonica* close to *marwicki* Allan.

Omalaxis amoenus Murdoch and Suter, 1906 should, as Iredale has contended (1915, p. 461), be referred in the meantime to *Heliacus*, larger shells than the type showing the characteristic rounding and descending of the whorls.

Discohelix meridionalis Hedley, 1903 has been recorded by Miss Mestayer *(Trans. N.Z. Inst.*, vol. 48, p. 125, 1916), but further examination of the sole fragmentary specimen would probably lead to its identification with the previous species. As, however, these Agadinoids have a wide distribution, and I have not seen Miss Mestayer's shell, the record cannot be definitely rejected at present.

It has already been noted that the new genus *Zerotula* for *Discohelix hedleyi* Mestayer and *Omalogyra bicarinata* Suter should be placed in this family.

Genus **Epitonium** Bolten, 1798. [P. 319]

Powell has added a species by describing *Epitonium bucknilli* nov. *(Trans. N.Z. Inst.*, vol. 55, p. 138, 1924).

The earliest name is undoubtedly *Scala* Humphrey, 1797 of the *Museum Calonnianum* (p. 23) and the family name must revert to *Scalidae*, one of the pleasing changes that occur. The grouping of the Neozelanic species needs careful consideration; de Boury made a life study of these fascinating shells, but did not live to complete his monograph and see it published.

Epitonium parvicostata and *simplex* Marshall *(Trans. N.Z. Inst.*, vol. 49, p. 451, 1917) (which I have referred to *Tenuiscala; Proc. Mal. Soc.*, vol. 16, p. 102, 1924), *tricinctum* Marshall *(l.c.*, vol. 50, p. 263, 1918), *tenuispiralis* Marshall *(l.c.*, vol. 51, p. 227, 1919), *Cirsostrema caelicola* Finlay *(l.c.*, vol. 56, p. 231, 1926), *C. angulata*

Marwick (*l.c.*, p. 320), and *Scalaria (Cirsostrema?) pacifica* Wilckens (1922, p. 8) (Cretaceous) must be added to the list of fossil species.

The beautiful shell named *Scala laevifoliata* by Murdoch and Suter is so distinct that it probably does not even belong to this family. It is quite unlike any of the groups indicated by de Boury, who would probably also have denied it relationship. I propose the new genus *Murdochella* (with this species as type) for this group, which also occurs in Australian waters, and of which there are at least three other distinct Neozelanic members, one of which I here describe. Hedley has identified an Australian shell with Murdoch and Suter's species, but in view of the slight differences between species in this genus, it is probable that re-examination would result in its description as new.

Murdochella alacer n. sp. (Fig. 41.)

Shell similar to *M. laevifoliata*, but stouter and less slender. Apex of same style, but larger and wider, only the incoiled tip smooth, the rest with rather distant strong curved axial ribs, not becoming laminate toward the close; not so well marked off from the succeeding whorls. Lower two keels on spire-whorls much more prominent (in *laevifoliata* the upper and lower are subequal and the median strongest), only a faint suggestion of a fourth subsutural thread on body-whorl; a carina as strong as lower keels emerging from suture, and between this and pillar one more strong cord. Axial lamellae fewer, stronger, and more distant, not stopped by carina but passing over whole base. Other details as in *laevifoliata*.

Height, 4.7 mm.; diameter, 1.6 mm.

Locality,—Near Cuvier Island, in 40 fathoms.

Genus **Crossea** A. Adams, 1865. [P. 324]

The Neozelanic specimens referred to *Crossea cancellata* Ten.-Woods, 1878 and to *C. labiata* Ten.-Woods, 1876 are quite distinct from these species and I describe them as new.

Iredale has proposed two new genera, *Crosseola* for *C. concinna* Angas, which will include the first named, and *Dolicrossea* for the latter (1924, p. 251). The animal of the former has not yet been examined, but the operculum proves to be horny and multispiral, and the genus therefore referable to the family *Liotiidae*.

The species *Crossea glabella* Murdoch is not congeneric with either, and is an endemic and very peculiar form. For it may be proposed the new generic name *Conjectura*. Tertiary forms of *Crosseola* and *Dolicrossea* are known to me from New Zealand, but *Conjectura* has not been met with except as a Recent shell, which, however, has a wide Neozelanic range.

Till more is known of the animals of these little shells it will be safest to include all these genera in the Family *Liotiidae* Iredale (*vide antea*).

Crosseola errata n. sp. (Fig. 33).

Shell related to *cancellata* Ten.-Woods, but differing in aperture and details of sculpture. Three strong spirals on spire-whorls, six and the umbilical cord on body-whorl; upper three by far the strongest, with interstices twice their width; lower three below aper-

ture, interstices much narrower than those above, but still about 1½ times width of ribs; no trace of a seventh rib. Axial lamellations coarse and thick, interstices 1½-2 times as wide. Umbilical rib stout and crenulated. Spire as high as aperture, somewhat tabulated, outlines straight; whorls squarely convex. Aperture with thickened sides, interior quite circular, no angle above, and no canaliculation at base, but the thickened and produced pillar forms with basal lip a slightly-grooved triangular pad, enfolded by umbilical cord. Very narrow chink-like shallow umbilicus.

Height, 2 mm.; diameter, 1.9 mm.

Locality,—Awanui Bay, North Auckland, dredged in 12 fathoms.

Dolicrossea vesca n. sp. (Fig. 32).

Shell small, globose, thin, and fragile. Sculpture of spiral sublinear grooves, about 8 on penultimate whorl and 30 on body-whorl; no narrow smooth zone above umbilical rim, but grooves continued over basal cord and weakly into umbilicus. Spire short, but little over half height of aperture, outlines straight. Whorls convex, base flattish. Suture distinct. Aperture obliquely pyriform, angled above, rounded below, with a very slightly canaliculate pointed anterior emargination. Peristome continuous. Outer lip thin and sharp, not reflexed or fringed. Basal lip hardly truncated, pointed at the pillar. A low wide cord encircles pillar and margins umbilicus which is narrow and short. Inner lip and columella as in *D. labiata.*

Height, 2.5 mm.; diameter, 2 mm.

Locality,—Lyall Bay, Wellington.

Abundantly distinct in tenuity, outer lip, relative proportions, spire, and aperture, from true *labiata.*

Genus **Aclis** Lovén, 1846. [P. 325]

This must disappear from Neozelanic literature. *Aclis succincta* has herein been placed in the *Rissoidae* in a genus *Brookesena;* and the Pliocene *Aclis costellata* Hutton has been referred to *Fossaridae* in (temporarily) my genus *Zeradina; Aclis semireticulata* Murdoch and Suter is just as aberrant. It belongs to a series that goes far back into the Tertiary, and there are other Recent forms known to me. I here describe three allied forms, and propose for the group *Powellia* n. gen. (after my able friend, A. W. B. Powell, whose fine work on New Zealand shells is so welcome), naming *P. lactea* n. sp. as type; owing to lack of knowledge of the animals, the genus is of uncertain affinities, but may be temporarily located in the Family Rissoidae.

Powellia lactea n.sp. (Figs. 47, 48.)

Shell subulate, highly polished, milk-white. Apex blunt, subpapillate, smooth, and polished, not marked off from true shell, which is also quite smooth, but with an indication of a subangle just above suture, forming periphery of body-whorl. Spire nearly twice height of aperture, outlines straight or a trifle concave. Whorls gently convex, most swollen near lower suture. Aperture pyriform, subangled above, distinctly pouting and emarginate below; outer lip very crass, backed by a wide rounded strong varix, inclined forward anteriorly, and set a little behind the edge; inner lip very thin,

distinct, peristome continuous. Umbilicus chink-like, not covered, and surrounded by a blunt angulation. Pillar excavated and produced.

Height, 3.3 mm.; diameter, 1.4 mm.

Locality,—Pukeuri sandy clays (Awamoan, i.e. "Miocene") near Oamaru. Fairly common.

Powellia comes n. sp. (Fig. 45, 46).

Shell like the preceding form, but smaller, more inflated, and less slender. Whorls more convex, with deeper sutures. Peripheral subangle marked by a thread, indications of other spiral threads present. Faint axial plicae on upper whorls. Spire about 1½ times aperture in height, outlines a trifle convex. Outer lip and varix not nearly so crass as in last species, aperture suboval, less emarginate below. Umbilicus about same size, but less prominent, due to absence of encircling blunt angulation and rounder base.

Height, 2 mm.; diameter, 1.2 mm.

Locality,—Same as last species. Nearly related to the Recent *semireticulata* M. & S., but shorter, with weaker peripheral thread and umbilicus.

Powellia paupereques n. sp. (Figs. 43, 44).

Shell resembling *C. comes* in size, but with much less convex whorls, and heavily variced aperture. Distinguished from all the other species by the suture being submargined below as well as above. Only very faint traces of spiral threads over the polished surface, but the peripheral thread is strong. Traces of close axial ribs present. Whorls very lightly and regularly convex. Spire 1½ times height of aperture, outlines convex. Aperture as in *comes* but more pressed against parietal wall; outer lip with a narrow heavy varix some distance behind edge, strongly inclined forward anteriorly. Umbilicus almost hidden.

Height, 2.4 mm.; diameter, 1.4 mm.

Locality,—Off the Poor Knights Islands in 60 fathoms.

Powellia semireticulata (M. and S., 1906). [P. 326]

As the figure of this species given in the "Atlas" (Plate 16, fig. 5) is not good, emphasising the sculpture far too much, I present another figure, (Fig. 49) taken from the type in the Dominion Museum. The dimensions of the type given by Suter are incorrect; they should be 2.8 mm. by 1.6 mm. Odhner has sent me specimens identified as this species, from 35 f., Colville Channel, North Is.; they are a n. sp., close to *Linemera gradata* (Hutt.), and not related to *Powellia.*

This species differs from *paupereques* in its thinner, less polished shell, stronger axial sculpture, taller spire (about twice height of aperture), more convex whorls, deeper sutures, and less heavily variced outer lip.

Genus **Eulimella** Jeffreys, 1847. [P. 329]

E. awamoaensis M. & M. has been described from the Tertiary (*Trans. N.Z. Inst.,* vol. 53, p. 83, 1921).

Syrnola pulchra Brazier, 1877. [P. 331]

This is not a constituent of the Neozelanic fauna, the single shell Suter so identified being easily distinguished, so I now describe it as new.

Syrnola menda n. sp. (Figs. 50, 51).

Shell very tall and slender, polished, and shining, perfectly smooth except for inconspicuous growth-lines. Apex heterostrophe, set not quite at right angles to shell-whorls. Spire very high, slowly tapering. Whorls 11, subangled close to lower suture, then cut in sharply to suture, straight or faintly concave above subangle till very near upper suture, then suddenly rounded in to suture, which is thus deeply cut. Colour whitish-grey, with a brown band just above the subangle on all whorls, no second band on base, which is flatly convex, rapidly contracted below periphery. Aperture short, subrhomboidal, basal lip rounded into outer lip, elsewhere with straight sides, no lines of striae. Pillar with a moderately strong plait. Umbilicus narrow, open.

Height, 6.7 mm.; diameter, 1.3 mm.

Locality,—Near Cuvier Island in 40 fathoms.

Differs from *S. pulchra* Brazier among other things in longer and more slender shell, much more rapidly-rounded base and shorter aperture, absence of second colour-band on base, and weaker columellar plait.

A Tertiary species of *Syrnola* has been described as *S. semiconcava* M. & M. (*Trans. N.Z. Inst.*, vol. 54, p. 122, 1923).

Pyramidella tenuiplicata Murdoch and Suter, 1906. [P. 332]

The type of this species is a mere apical fragment. It was absurd to describe it; Pyramidellids are difficult enough to identify from perfect specimens, and it is asking too much to expect recognition of one from type material so poor as this. The name must be neglected till topotypes are available, and even then may prove indeterminable. In the meantime no records of this species can be safely made.

Odostomia bembix Suter, 1908. [P. 335]

This must give place to *Odostomia georgiana* Hutton (*Trans. N.Z. Inst.*, vol. 17, p. 319, 1885). The type shells of this Upper Pliocene species are not separable from abundant topotypes (and many specimens from other localities) of Suter's *bembix*. I would like to reduce *stygia* Suter also to a synonym of Hutton's species, but not having seen the holotype, refrain at present from uniting them; *stygia* may be retainable as a deep-water smaller representative of *georgiana* Hutton, though I feel considerable doubt about it.

Odostomia impolita (Hutton, 1873). [P. 343]

This species must likewise be dropped. The type specimen consists of three unrecognizable fragments gummed on a slide. Hutton's original diagnosis contains no specific characters, and the type is said to come from Stewart Island where three or four Evaleas can be found, so that the only solution is to drop Hutton's *Rissoa impolita* as indeterminable. Suter has described *E. liricincta* from Port

Pegasus, Stewart Island; *chordata* Suter is a northern form; while the Upper Pliocene *huttoni* Suter (*Trans. N.Z. Inst.*, vol. 40, p. 368. 1907) and *obsoleta* Murdoch (*l.c.*, vol. 32, p. 217, 1900) will have to be noted when identifications are being made.

Genus **Pyrgulina** A. Ad., 1863. [P. 344]

Ancestral forms to *rugata* (Hutt.) await description; the Tertiary *pseudorugata* M. & M. (*Trans. N.Z. Inst.*, vol. 53, p. 83, 1921) is not in direct lineage, though closely allied; it represents another branch, of which I have several new species.

Genus **Menestho** Moeller, 1842. [P. 345]

This name must be dismissed from Neozelanic literature; it was bestowed on a Greenland species, and the sole member admitted by Suter has little alliance with the type. Following Dall and Bartsch, Suter admits *Evalea* for forms with simple grooves, and *Menestho* for shells which have the grooves traversed by thin axial threads. It is doubtful whether such a distinction is at all useful, for the growth-lines in species of *Evalea* frequently produce minute fenestrations in the grooves. One is, however, less concerned with this point than with the grouping of the New Zealand species, and it is to be noted that all well-preserved specimens of *Evalea liricincta* Suter and of what has been taken for *E. impolita* (Hutton) show more or less distinct axial threadlets in the interstices. Suter's *Menestho sabulosa* certainly should not be cut adrift from these species, in fact I would suggest that when the types are compared it may prove inseparable from *liricincta*, in which case *liricincta* has place priority; topotypes of the two species agree entirely. I conclude that *Menestho* is unnecessary in New Zealand, and would refer the following species to *Evalea*—*sabulosa* Suter, *liricincta* Suter, *chordata* Suter, *huttoni* Suter, and *obsoleta* Murd.

Genus **Turbonilla** Risso, 1826. [P. 332]

Several additions have lately been made to the sole representative of this genus included by Suter:—

T. (Pyrgolampros) blanda Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 522, 1924).
T. campbellica Odhner (1924, p. 33); from Campbell Island.
T. powelli Bucknill (*Proc. Mal. Soc.*, vol. 16, pt. 3, p. 122, 1924).
T. finlayi Powell (*Trans. N.Z. Inst.*, vol. 56, p. 594, 1926).
T. lamyi Hedley (1916, p. 63); from Macquarie Island.
T. suteri Powell (*Rec. Cant. Mus.*, vol. 3, pt. 1, p. 47, 1926).

As regards Tertiary species, *T. oamarutica* Suter has been removed to the *Epitoniidae* and made the type of a new genus *Notacirsa* (Finlay, *Trans. N.Z. Inst.*, vol. 56, p. 231, 1926); possibly *T. prisca* Suter should go with it, but its position must remain in doubt till the apex is known. This leaves the only fossil species so far recorded as *T. awamoaensis* Marshall and Murdoch (*Trans. N.Z. Inst.*, vol. 53, p. 84, 1921) and *T. antiqua* Marshall (*loc. cit.*, vol. 51, p. 228, 1919) (renamed elsewhere in this volume).

Family **Eulimidae**. [P. 346]

The genus *Teretianax* Iredale, 1918 (*Proc. Mal. Soc.*, vol. 13, p. 39), considered by its author as doubtfully referable to this family, has been added to the Recent fauna by Powell (*Trans. N.Z. Inst.*, vol. 56, p. 596, 1926) with the description of *T. pagoda* nov.—the second known species—from several North Cookian localities.

Eulima itself has had three Tertiary species lately described, *aoteaensis* M. & M. (*Trans. N.Z. Inst.*, vol. 53, p. 84, 1921), *christyi* Marwick (*l.c.*, vol. 55, p. 195, 1924), and *waihaoensis* Allan (*l.c.*, vol. 56, p. 339, 1926).

Genus **Fusinus** Rafinesque, 1815. [P. 357]

The name *Colus* Humphrey, 1797 (*Mus. Calonn.*, p. 34) takes precedence over *Fusinus* Rafinesque, but the name is applicable in New Zealand only to some of the Lower Tertiary species. A full treatment of the Neozelanic forms is withheld, as there are so many new species to describe, and there are already several synonyms among the proposed species. The only living member of the group in this region, however (excepting *Columbarium suteri* Smith, 1915; *Brit. Antarc. "Terra Nova" Exped.*, vol. 2, no. 4, p. 87; see also Mestayer, *Trans. N.Z. Inst.*, vol. 48, p. 126, 1916), ***Fusus spiralis*** A. Ad., is so distinct from *Colus*, and represents the culmination of so well-defined a group that there can be no hesitation in proposing for it a new genus *Coluzea*. In lineage may be named ***Fusus dentatus*** (Hutton) (*Trans. N.Z. Inst.*, vol. 9, p. 594, 1877), ***Fusinus maorium*** Marshall and Murdoch (*l.c.*, vol. 51, p. 254, 1919), ***F. climacotus*** Suter (*N.Z.G.S. Pal. Bull. No.* 5, p. 21, 1917), and many new species. The striking protoconch, of the genotype especially (bulbous, flat-topped, with whorls subangular at the top, strongly keeled at the end), the single, strong, serrate keel, and *Columbarium*-like facies, are all highly characteristic. *Euthriofusus tangituensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 320, 1926) is like a *Colus* in many respects but I have not seen actual specimens.

Family **Mitridae** A. Adams. [P. 359]

Much confusion centres round the New Zealand forms grouped here. "The shells referred to the Family *Mitridae* show so much diversity in the radular characters as to suggest polyphyletic origin. Troschel years ago divorced the series widely, but shell characters and *laisse faire* have ruled since, so that the Family "Mitridae," as shown for example in the British Museum, is an incongruous association of species. Cooke has recently reviewed the radulae (*Proc. Zool. Soc.*, 1919, pp. 405-422), and, ignoring the shells altogether, has simply grouped them by this means, and in Group 1—***Mitra*** Martyn he includes ***M. glabra*** Swainson (Tasmania) and ***M. rhodia*** Reeve (Port Jackson)." (T. Iredale, *in litt.*). These shells closely resemble the species Suter includes [P. 361] as ***Mitra carbonaria*** Swainson (which is described below as ***Mitra maoria*** nov.) and the Tertiary species ***Mitra hectori*** Hutton (*Trans. N.Z. Inst.*, vol. 37, p. 473, 1904), ***M. eusulcata*** Finlay, and ***M. elatior*** Finlay (*loc. cit.*, vol. 55, p. 468, 1924), so that the genus name *Mitra* may be retained in Neozelanic literature.

Besides these fairly typical forms, other kinds of *Mitra* are known from New Zealand Tertiary beds. Marshall *(Trans. N.Z. Inst.,* vol. 50, p. 266, 1918) has described three species from Pakaurangi Point as *Cymbiola masefieldi, nitens,* and *calcar.* Marwick *(l.c.,* vol. 56, p. 264, 1926) has noted that these are "not Volutes, but belong to the Mitridae, though none of the present genera fit them well." In shell features, however, they are not very far removed from *Mitra* s. str. though in radular characters they may have differed. There is an Australasian Tertiary group of fairly large Mitras with long aperture and snout and a tendency to suppression of the lower two plaits (sometimes in adult shells only the uppermost remains), as opposed to the Recent *glabra—rhodia—maoria* group with short aperture and pillar and four or more strong and regular plaits. For this group, which includes Marshall's three species, I propose the name *Diplomitra* nov., with *Cymbiola nitens* Marshall as type; here may be referred the Australian Tertiary *M. alokiza* T.-W. *(Proc. Linn. Soc. N.S.W.,* vol. 4, p. 9, 1880), *M. dictua* T.-W. *(l.c.),* and *M. monoploca* Finlay (new name given elsewhere in this volume to *M. uniplica* Tate, preoccupied). This group of *Mitra* is not at present known in New Zealand elsewhere than at Pakaurangi Point.

The use of the genus name *Conomitra* Conrad, 1865 for some austral Tertiary forms is due originally to Harris (*Cat. Tert. Moll. B.M.,* p. 129, 1897) who there classed *othone* (T.-W.), *dennanti* (Tate), and *ligata* (Tate). The last species is placed later in this paper in *Microvoluta*; the other two are closely allied, and have Neozelanic representatives in *Mitra inconspicua* Hutton *(Trans. N.Z. Inst.,* vol. 17, p. 326, 1885), *Vexillum apicicostatum* Suter *(N.Z.G.S. Pal. Bull. No.* 5, p. 27, 1917), and *Conomitra othoniana* Finlay *(Trans. N.Z. Inst.,* vol. 55, p. 467, 1924). *Inconspicua* has been definitely localized by Allan *(l.c.,* vol. 56, p. 341, 1926) as occurring only in the Waimatean stage, and falsely recorded from the Awamoan, while I have compared it *(l.c.,* vol. 55, p. 468, 1924) with the Australian *complanata* Tate. All these species may be embraced in the new genus *Waimatea* here proposed, with *Mitra inconspicua* Hutton as type. *Mitra fusoides* Lea, the genotype of *Conomitra,* and the assemblage of Paris Basin shells placed in this genus by Cossmann differ in whorling and snout, and are more regularly biconic than these austral forms.

Mitra albopicta Smith, 1898. [P. 360]

In the Dominion Museum is a tablet marked "*Mitra albopicta* Sm., co-type, Mohokinau, 453" on one side, but labelled "*Paratypes*" on the reverse. These are certainly authentic examples of Smith's species, agreeing in detail with his description and figure. But they also agree in detail with the type specimen of *Mitra obscura* Hutton, which is from the Bay of Islands, and which Suter records also from Mohokinau Island. Hutton's name has 25 years' priority, and must replace that of Smith. Cooke has compared *albopicta* Smith with *M. pica* Reeve, and this seems indeed to be a close ally.

Mitra hedleyi Murdoch, 1905, looks like a juvenile shell and may be a *Microvoluta,* but definite location must be deferred at present.

Mitra maoria n. sp. (Fig. 57).

A full diagnosis of this species cannot be given till better specimens turn up; all those found so far are much worn. Shell moderately large. Surface quite smooth, but very much rubbed; traces of linear spiral grooves visible. Spire about 1¼ times height of aperture. Whorls flatly convex, very faintly and bluntly shouldered at upper 2/3, body-whorl oblique below this sub-shoulder, then bent in rather suddenly at base. Suture apparently narrowly canaliculate—at least in worn shells. Aperture sharply angled above, widely open below, outer lip almost vertical, basal lip horizontal, not notched. Pillar stout, markedly oblique, with five strong close plaits, decreasing in strength from top downwards, a trace of a sixth at the bottom. Colour light brown, with a yellowish tinge.

Height, 48 mm. (true height probably about 58 mm.); diameter, 17 mm.

Locality,—Tauranga beach.

Genus **Vexillum** Bolten, 1798. [P. 364]

Under this head Suter includes six species, but at least four good conchological groups are represented, while several alterations are necessary in the species names. First, *Vexillum marginatum* (Hutton) was erroneously used by Suter to replace the species he and Murdoch described as *Vulpecula biconica;* Hutton's shell is from the Upper Pliocene and is not only quite distinct from *biconica* (as Smith concluded ten years ago; *Brit. Antarc. Exped., Zool.,* vol. 2, No. 4, pt. 1, p. 85, 1915) but belongs to a different group; *marginatum* does not seem to occur Recent. Hedley wrote Iredale some years ago, "May not *Vexillum marginatum* Hutton be *Mitra novaezelandiae* Filhol, *Mission Ile Campbell,* vol. 4, pt. 2, p. 554, 1885?" This name does not appear in Suter's work at all, and upon reference to Filhol's work it is found to be simply a new name for *Mitra zebra* Hutton, not Reeve. Filhol seems to have erred in ascribing such a name to Hutton, so that his substitute has no standing. *Columbella zebra* Gray was included by Hutton in his *Man. N.Z. Moll.,* 1880 (p. 61), and Filhol may have had this in mind.

Secondly, Suter has introduced a new species *pseudomarginata,* ranking his previously named *angulata* as a variety; if the forms deserved only varietal rank, *angulata* would have to become the species, and *pseudomarginata* the varietal name, but both forms are worthy of specific rank, and here again, when subdivision is fully carried out, will probably be placed in different groups.

Lastly, *Turricula planata* Hutton has also been misapplied by Suter: it is a Pliocene species, and though Suter commented on its large size, he used it as the name for a common northern littoral shell. The type of *planata* is quite distinct from "*planata*" auct., therefore I describe the Recent shell below as a new species.

The radulae of the *Vexillum* species show two very distinct styles; the distinguishing feature of the group is the unicuspid lateral, but while one series of *Vexillum* has a multicuspid rachidian tooth, the other has a regular tricuspid Buccinoid central tooth. The former of these is cited by Cooke for *V. tasmanicum* Ten.-Woods, and *V. teresiae* Ten.-Woods, both from Tasmania, and the latter for

V. australe Swainson from North Tasmania. Neither of these two shell types can be quite matched in New Zealand, and the Neozelanic groups seem to be aberrant even when gauged by the Tasmanian forms, which in themselves are not typical. It is, therefore, best to introduce new group names for the Neozelanic forms which are also known as fossils.

A full subdivision of the New Zealand species is not by any means carried out here; the time for that is not yet ripe; but the four groups proposed are the main ones and produce a satisfactory arrangement of most of the forms. They are as follows:—

Genus *Austromitra* nov. Type: *Columbella rubiginosa* Hutton.

This will cover a large and characteristic austral series, and, in New Zealand, includes besides the type *rubiradix* n. sp. (=*planata* auct.), *planata* (Hutton), *antipodum* (Brookes) (*Trans. N.Z. Inst.*, vol. 56, p. 588, 1926), *ambulacra* (Marwick) (*l.c.*, p. 320), *pseudomarginata* (Suter), *marginata* (Hutton) (not *biconica* M. & S.), and, provisionally, *angulata* (Suter) and *fracta* (Marwick) (*l.c.*, p. 321).

This group seems to have many Tasmanian allies, such as *analogica* Reeve, *legrandi* Ten.-Woods, *pumilio* May, *scalariformis* Ten.-Woods, *bellapicta* Verco, etc.

Genus *Microvoluta* Angas, 1877. Type: *M. australis* Ang., 1877.

In this genus, which was introduced in *Proc. Zool. Soc.* for 1877, p. 34, I include the Recent *Vulpecula biconica* M. & S., and the Pliocene *Turricula lincta* Hutton, from Petane, while I know of another new Recent species. The group is characterized by its twisted beak and weak irregular plaits, as opposed to the very strong plaits of *Austromitra*, which sweep over the whole base and regularly diminish from the top. The New Zealand shells are more allied to *M. royana* Iredale (*P.L.S.N.S.W.*, vol. 49, pt. 3, p. 269, 1924) than they are to the genotype, while the Australian Balcombian forms, such as *M. ligata* (Tate) (see also nomenclatural note elsewhere in this volume), are somewhat intermediate in character. Iredale (*l.c.*) notes that this genus really does belong to the Volutidae as Angas thought, and not to the Mitridae where it has been generally placed, the radula being very similar to that of *Scaphella undulata*.

Genus *Proximitra* nov. Type: *Vexillum rutidolomum* Suter.

A Tertiary series, comprising the type named (*N.Z.G.S. Pal. Bull. No.* 5, p. 29, 1917), *apicalis* (Hutton) (*Cat. Tert. Moll.*, p. 7, 1873), *enysi* (Hutton) (*l.c.*, p. 7), *suteri* (Finlay) (*Proc. Mal. Soc.*, vol. 16, p. 102, 1924=*ligata* Suter, preoccupied), *parki* (Allan) (*Trans. N.Z. Inst.*, vol. 56, p. 341, 1926), and possibly *plicatellum* (M. & M.) (*l.c.*, vol. 54, p. 123, 1923). The types of *apicalis* and *enysi*, regarded as lost by Suter, have been discovered, together with other "lost" specimens, by Dr. Marwick, who writes me regarding them: "*V. apicale* Hutton. Buchanan's drawing, published by Suter gives a very good idea of the appearance of this shell. The latter's statement that there are 25 nodules on the shoulder-angle was based on two specimens from Awamoa, mentioned as plesiotypes. They, however, differ much in shape from Hutton's holotype, and represent an undescribed species, wrongly identified by Suter at another time

(*N.Z.G.S. Pal. Bull. No.* 8, p. 75, 1921) as *V. linctum* Hutton. Locality, Awamoa (fide Hutton), also common at Pukeuri." "*V. enysi* Hutton. Distinguished from *apicale* by greater size, fewer knobs per whorl, and lower spire. Locality, Broken River (Lower)."

With this group, quite provisionally, may be associated *Mitra obscura* (Hutton) (=*albopicta* Smith), with, as has been mentioned, its Australian ally *pica* Reeve, and *Mitra mortenseni* Odhner (1924, p. 34).

Genus *Egestas* nov. Type: *Vexillum watei* Suter.

The type and a direct Tertiary ancestor, *V. fenestratum* Suter (*N.Z. Geol. Surv. Pal. Bull. No.* 5, p. 28, 1917) comprise this last group, widely sundered from the others by shell form and the possession of only three plaits. *Uromitra etremoides* Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 469, 1926) and *Vexillum lornense* Marwick, 1926 (*Trans. N.Z. Inst.*, vol. 56, p. 314) also have three columellar plaits, but a quite different facies, and do not seem to belong to any of the groups here outlined.

Austromitra rubiradix n. sp.

Shell similar to *rubiginosa*, but narrower and with different colour-pattern. Axial sculpture the same, but obsolete on most of last whorl; spirals much finer, dense minute grooves, a single strong cord beheading axials on shoulder. Colour uniformly blackish, with a slight purplish tinge, only the pillar and fasciole area reddish-orange brown, no bands on spire. Pillar plaits somewhat weaker than in *rubiginosa* (Hutton) and *antipodum* (Brookes), aperture more compressed, spire a trifle higher and more convex.

Height, 8 mm.; diameter, 3.5 mm.

Locality,—Whangaroa Harbour (type); generally distributed in the north of the Cookian Province and restricted to it.

This is the Recent species erroneously taken for *planata* (Hutton).

Siphonalia nodosa (Martyn, 1784). [P. 368]

When Iredale wrote his "Commentary," he proposed *Aethocola* as a subgenus for Martyn's species. This form has been found to be well represented in the Tertiary, a number of species having been named and *Aethocola* raised to generic rank. Recently I have pointed out (*Proc. Mal. Soc.*, vol. 16, pt. 2, p. 102, 1924) that Martyn's specific name had been anticipated by Solander for a different species, an item overlooked by Iredale. Depending upon Suter's synonymy, I selected *raphanus* Lamarck as the next available name. Iredale, however, tells me that the species had been well figured by Chemnitz, and had been named *Drupa glans* by Bolten (*Mus. Bolten*, p. 56, 1798; for Chemnitz, 10, t. 163, f. 1558). Lamarck's *Fusus raphanus* was given in a Liste, p. 8, 1886 explanatory to the shells figured in the *Tabl. Encycl. Method*, Pl. 435, fig 1, and when he wrote his *Hist. Anim. s. Verteb.*, Vol. 7, 1822, p. 128, Lamarck included under his species name only the references to Martyn, Chemnitz, and the *Encycl. Meth.*, which may account for the neglect of Bolten's name.

It is unfortunate, too, that the decision regarding *Austrofusus* must be reversed, as it must come into use for this group. When Martens wrote up the early years of the Zoological Record, he used to make comments, and in the volume for 1881, Mollusca, p. 40, records "*Austrofusus*, subgen. n. of *Neptunea*, type *N. nodosa* (Martyn) = *raphanus* (Lamark); Kobelt, J. B., mal Ges. 8, p. 321." This must be accepted, but why Martens selected this species, which simply figures midway in Kobelt's list, cannot now be ascertained. After many vicissitudes this species therefore comes to rest—one hopes finally—as *Austrofusus glans* (Bolten, 1798). This is typically a Cookian form, the Forsterian representative has been described elsewhere in this volume as *Austrofusus glans agrestior* Finlay.

For a further discussion of the Tertiary forms of *Austrofusus* and its allies, descriptions of new species and removal of the genus to the *Buccinidae*, see Finlay, *Trans. N.Z. Inst.*, vol. 56, pp. 232-238, 1926. Three group names were proposed for the fossils: *Neocola* (for *Austrofusus beta* Finlay) (p. 232), *Zelandiella* (for *Neptunea subnodosa* Hutton) (p. 232), and *Nassicola* (for *Neptunea costata* Hutton) (*l.c.*, vol. 54, p. 514, 1924). The sole species described since that account, *Aethocola cliftonensis* Marwick (*l.c.*, vol. 56, p. 321, 1926) may be located in *Neocola*.

Verconella dilatata (Q. and G., 1833) [P. 370]

The recognition of this species has given much trouble. The shell that Quoy and Gaimard described was dredged in 25 fathoms in the Bay of Islands, and was pictured by them as having a short canal, rather squat and wide shell, and fine spiral lirae. Quoy and Gaimard's figures are so exact and careful that there is no reason to regard their illustration as incorrect in this case. The common littoral Northern shell disagrees in having coarse lirae and being altogether a more massive shell; this form should, as Hedley has pointed out (*N.Z. Journ. Sci. and Tech.*, vol. 3, no. 1, p. 54; no. 3, p. 170, and no. 4, p. 222, 1920) take the name *adusta* Philippi, but I do not approve of Hedley's action in deflecting Quoy and Gaimard's name to the large deep-water *Verconella* called *Megalatractus maximus* by Suter. This form is, though larger than any of the others, quite thin, with a very long canal and fine lirae. It evidently cannot be Quoy and Gaimard's shell, but may be regarded as a benthal form of the true *dilatata*, for which I now propose the trinomial *Verconella* (*dilatata*) *rex* n. subsp., and figure as type (Figs. 71, 72) a specimen in the Finlay collection (measuring 154 mm. by 65 mm.) from off Whakatane, Bay of Plenty, in 40 fathoms. The identity of true *dilatata* cannot be settled until exact topotypes are dredged, but in the meantime I advance as the best expression of Quoy and Gaimard's species I have seen a shell from the Castlecliff beds here figured (Fig. 70); this is obviously neither *adusta* nor *rex*, but has the short canal and fine lirae of *dilatata*. *V. mandarina* (Duclos), as Iredale has stated, undoubtedly goes generically with these forms, while in lineage may be named the Tertiary *Fusus crawfordi* Hutton (*Cat. Tert. Moll.*, p. 3, 1873), *Buccinum inflatum* Hutton (*l.c.*, p. 6; referred to *Verconella* by Finlay, *Proc. Mal. Soc.*, vol. 16, p. 103, 1924), and numerous undescribed species.

Powell has some further notes on this genus, and adds to it five more Recent species elsewhere in this volume.

A large number of Tertiary species have been described under the name *Verconella,* but not one of them is really referable to it. Four are dealt with in the note (later) on *Siphonalia valedicta; V. delicatula* M. and M. (*Trans. N.Z. Inst.*, vol. 54, p. 123, 1923) is a *Colus;* while *spiralis, uttleyi,* and *formosa* Allan (*l.c.,* vol. 56, p. 340, 1926) are Turrids, belonging to a characteristic early Tertiary group which contains also *Siphonalia senilis* M. and M. (*l.c.*, vol. 52, p. 131, 1920), *Surcula serotina* Suter (*N.Z.G.S. Pal. Bull. No. 5,* p. 52, 1917), *Daphnella ovata* and *multicincta* Marshall (*l.c.*, vol. 49, p. 457, 1917), and *Belophos incertus* Marshall (*l.c.,* vol. 51, p. 229, 1919). The last named species, described from Hampden, is, from comparison of the types, a synonym of the earlier *Daphnella neozelanica* Suter (*N.Z.G.S. Pal. Bull. No. 5,* p. 60, 1917), based on a fragmentary specimen from the "Esdaile Collection, Teaneraki;" this locality has been shown by Marwick (*N.Z. Journ Sci. and Tech.*, vol. 6, p. 280, 1924) to refer really to the "greensand, McCulloughs Bridge, Waihao River," which is of the same age as the Hampden beds. Allan (*Trans. N.Z. Inst.*, vol. 56, p. 341; Pl. 76, f. 8) has lately figured an adult example from McCulloughs Bridge which perfectly corresponds with Marshall's *incertus.* For this group, which is somewhat like *Austrotoma* Finlay in facies and embryo, but has a Verconellid aperture, without trace of an anterior notch, and only a wide and shallow posterior sinus, I now propose the genus name *Marshallena* (with *Belophos incertus* Marshall=*neozelanica* Suter as type), as a mark of admiration for the magnificent pioneer work Dr. P. Marshall has done for New Zealand Palaeontology.

The genus *Iredalula* Finlay (*Trans. N.Z. Inst.* vol. 56, p. 231, 1926) for the Tertiary *Bela striata* Hutton, may perhaps be placed near the Verconellidae, but its affinities are at present obscure.

Siphonalia caudata (Q. and G., 1833). [P. 371]

This is another of Quoy and Gaimard's species that does not appear to have been met with since their time; I suggest that when it does turn up it will be found to be either related to the "Miocene" *Siphonalia excelsa* Suter (*N.Z. Geol. Surv. Pal. Bull. No. 5,* p. 30, 1917), which I have (elsewhere in this volume) referred to *Austrosipho* Cossmann (*Ess. de Pal. Comp.,* livr. 7, p. 229, 1906); or a member of my genus *Zeatrophon* (*vide post*). I think the latter is more probable, as I have specimens of true *Zeatrophon* from deep water in Hauraki Gulf and off Otago Heads which closely resemble Quoy and Gaimard's figure, though not one of them is exactly like it.

Suter's obscure figure of *caudata* in the "Atlas" does not agree with the original one, but represents, Iredale informs me, the species named *Fusus vulpicolor* by Sowerby (*Thes. Conch.*, vol. 3, p. 78, Pl. 411, Fig. 73, 1880), which was described from New Zealand and then erroneously referred to the Falkland Islands, the type in the British Museum being labelled New Zealand. I have collected it alive in deep water in Otago, and Iredale's record of *valedicta* (*Trans. N.Z. Inst.*, vol. 40, p. 383, 1908) refers to this species. It

seems almost certain that no one has troubled to investigate the apex of this shell, for it is so radically different from that of any other *Verconella* that it would surely have provoked comment. Suter says it is of "two smooth whorls, small and globose"—an extraordinary statement. I was fortunate in finding egg-capsules and all growth stages of this species in 60 fathoms off Otago Heads, and it proves to be viviparous. Inside a circular wafer-shaped horny egg-case are found about a dozen progeny, consisting of the embryo and a whorl or so of true shell. The embryo is pagodiform, very strongly carinate, rising to a crude tip; it is everywhere coarse and roughened which suggests that it also may have been cased in a horny capsule that was early lost. I have therefore no hesitation in providing for this elegant form the new generic name *Glaphyrina,* and as Suter's illustration is extremely poor, I refigure this species from a specimen in my collection dredged off Otago Heads in 60 fathoms (Fig. 80). A closely allied direct ancestor is found in the Upper Pliocene Castlecliff beds; it differs only in finer sculpture (the spirals being more even and less prominent, and the axials absent on the last three whorls), deeper suture and rather thinner test. For it I provide the name *Glaphyrina* [*vulpicolor*] *progenitor* nov., the type being in the Finlay collection.

Siphonalia valedicta (Watson, 1886). [P. 372]

This likewise has not been met with again, but deep-water dredging will probably bring it to light. It seems to be a benthal relative of a series of shells well represented in the Pliocene, and of which several members have recently been described, viz., *Verconella marshalli* Murdoch (*Trans. N.Z. Inst.*, vol. 55, p. 159, 1924), *V. compta* Finlay (*loc. cit.*, p. 523), *V. dubia* Marwick, and perhaps *V. thomsoni* Marwick (*loc. cit.*, p. 196). The group seems related to *Verconella* s. str. by its apex (which, however, is much smaller) and canal, but shows constantly different whorling, and has a tendency, never shown by *Verconella,* to develop tubercles on the inner lip; palaeontological evidence shows that the two series have lived side by side for a long time. Accordingly, in my opinion, both are worth generic rank, and I provide for the *valedicta* group the new genus *Aeneator,* naming *V. marshalli* Murdoch as type.

Streptopelma henchmani Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 321, 1926) is somewhat allied to these forms but cannot be referred to either *Streptopelma* or *Aeneator.*

Genus **Euthria** Gray, 1850. [P. 373]

Oliver in his Ecological Essay (1923A) has reverted to *Euthria* for the whole of the Neozelanic forms, although the type of *Euthria* is a European shell of unlike shell characters and possesses a different radula. The smaller New Zealand "Euthrias" show a radula notably unlike that of "*Euthria*" *linea,* which more approaches that of the European type. Cooke has shown so clearly that the radula must be weightily considered in relation to shell characters that Oliver's retrograde step does not seem wise. If the whole series were to be lumped again, the name *Euthria* would also have to be rejected, on account of the prior *Buccinulum.*

It is very difficult to proceed to a natural grouping of the Neozelanic, "*Euthria*"—*Evarne* association, because (1) the style of shell and ornament is extremely simple and approximately the same throughout (2) there seem to be local colour-variants of several of the species, yet other forms which at first sight appear to belong to this category apparently have proved to possess different radulae—e.g., *E. flavescens,* (3) the forms being almost all littoral, there is a consequent dearth of available fossil members, so that the lineage in most cases cannot be traced.

First, the name *Evarne* must give way to *Buccinulum,* of which Iredale has designated *Buccinum lineatum* as type (*Proc. Mal. Soc.*, vol. 14, pts. 5-6, p. 208, 1921). Under this species Suter ranges two subspecies, *pertinax* von Martens and *traversi* Hutton. Von Martens' shell should at present be treated as distinct; it may remain in *Buccinulum* in the meantime till a range of specimens is available, but the few juvenile topotypes seen indicate that the form is possibly a *Euthrena. Fusus traversi* Hutton, however, must be removed from this neighbourhood altogether; the type proves to be an *Axymene* (*vide post,* under *Trophon*),and has nothing to do with the figure and interpretation given by Suter.

Near *Buccinulum* may be placed another group—that centering round *Cominella striata* Hutton (Pliocene), with which may at present be associated *Tritonidea fuscozonata* Suter, 1908, and the fossil *T. compacta* Suter, 1917 (with which I have united *T. elatior* Suter, 1917; *Trans. N.Z. Inst.* vol. 55, p. 503, 1924), and many new forms, though other groups will be separable when these are described. It is difficult to state absolute differential characters, but all have a large protoconch of several smooth whorls, showing more or less axial acceleration (though never a reticulate stage) before passing into the adult sculpture, which is typically prominently spiral (but the tendency is towards reduction of this in later members and littoral forms); a broad swollen varix occurs just before the aperture, the whorls are convex and inflated and not flattened as in *Euthrena,* and the canal is considerably longer than in that genus. *Buccinulum lineum,* though evidently related, stands out from this assemblage in its peculiar colour-pattern, smooth surface, still larger protoconch, and more gently wound columellar plait. *Euthrena,* on the other hand, has a very small protoconch, weakly axially ribbed at an early stage; before passing into adult sculpture (of low broad axials) there is a very well marked brephic stage of narrow strong axial and spiral cords producing a coarse reticulation, the points of intersection marked as blunt gemmules. For the *striata* group I therefore provide the name *Evarnula* nov., citing *Cominella striata* Hutton as type, and allotting it subgeneric rank under *Buccinulum.* Suter's type of *Tritonidea fuscozonata* is a badly beach-worn shell; I refigure the species from a fresh Whangaroa specimen in the Finlay collection (Fig. 77); from the same source are figured Castlecliff examples of *B. (Evarnula) striatum* (Hutton), since Hutton's original figure was very sketchy (Figs. 78, 79).

The remaining species may in the meantime be associated together under *Euthrena,* with *Fusus vittatus* Q. and G. as type, the

following points being noted. Suter's subspecies *costulata* is not close to *littorinoides*, but is far nearer to and may be identical with *vittata*, which itself appears to be a northerly form of the closely-related *martensiana*. The Chatham Island "*vittata*" is a peculiarly distinct form more sundered from true *vittata* than that species is from *martensiana* or than *littorinoides* is from *strebeli* and *flavescens;* for it must be restored Hutton's *Fusus bicinctus* (*Cat. Mar. Moll.*, p. 10, 1873), described from "Chatham Islands only."

"*Euthria striata* (Hutton)" is admitted to the Recent fauna by Suter, but the Recent shell obviously differs from the Pliocene type. I here describe the species as new.

Buccinulum sufflatum n. sp. (Figs. 75, 76).

Shell wide and solid. Embryo large, mamillate, smooth, tip flattened, central; a brephic stage of one or two axial riblets at its close. First two whorls after apex with 11-13 little stout axial riblets per whorl (interstices narrower), swollen on lower half, weak on shoulder; entirely absent on last three whorls. Spiral sculpture of moderately raised thickish cords with 1-4 weaker interstitial riblets; cords and interstitials stronger on base. Spire not quite as high as aperture with canal, outlines straight, hardly broken by sutures. Whorls gently concave on upper half, gently convex below, thus having a swollen and undulating appearance; body-whorl tumid on periphery, rapidly contracted on base. Suture distinct, slightly submargined below, the whorls clasping. Aperture pyriform, bulging, angled and channelled above, produced below into a moderately long open canal, flexed to left and faintly notched at base. Outer lip strongly convex, a little contracted near suture and at canal, with a sharp edge but rapidly thickened inside, and with many sharp strong lirae (roughly in pairs) situated well within, those near canal stronger and more distant. Inner lip well defined as a rather thick glaze over parietal wall and pillar, with about a dozen tubercles spread over its whole length, those on parietal wall elongated and ridge like, those below closer and suboval. Pillar deeply excavated in centre, with a strong twist below forming margin of canal. Fasciole fairly strong, slightly lamellose. Occasionally a tiny umbilical chink. Colour pure white, or with a yellowish-brown tinge.

Height, 35 mm.; diameter, 17 mm.

Locality,—Lyttelton Harbour.

Genus **Cominella** Gray, 1850. [P. 381]

I have already (*Trans. N.Z. Inst.*, vol. 56, pp. 238-244, 1926) treated of the New Zealand Tertiary and Recent species referred to this genus, and there is nothing futher to discuss at present. The following divisions were proposed in the paper noted: *Eucominia* (for *Buccinum nassoides* Reeve), *Cominula* (for *Cominella quoyana* A. Ad.), *Procominula* (for *Cominella pulchra* Suter), *Zephos* (for *Nassa cingulata* Hutton), *Acominia* (for *Buccinum adspersum* Brug.), and *Cominista* (for *Buccinum glandiforme* Reeve = *luridum* Philippi). *Cominella* s. str. is restricted to *Buccinum maculosum* Mart. and its relatives. In *Acominia* will be placed *C. hendersoni* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 322, 1926), while *C. compacta* Marwick (*l.c.*)

is either a *Procominula* or a *Cominella* (more probably the latter), depending on the character of the columella; I have not seen it. Suter, in connection with *Cominella maculosa* [P. 388], has written, "The *Buccinum catarracta* Chemnitz is considered by Tyron to be a mere colour variety of this species, and, as far as I know, Chemnitz gives New Zealand as the habitat; Krauss (*Sudafric. Moll.*, p. 119), on the other hand, claims it for the coast of Natal but I suspect that he wrongly identified his specimens." Chemnitz's species name has been used for the South African shell resembling the Neozelanic *Lepsiella scobina* (Q. and G.), but Iredale tells me that upon reference to Chemnitz one finds that the description and figure apply exactly to the South African shell known as *Cominella delalandii*, which, though resembling the Neozelanic species, is quite distinct, and belongs to *Burnupena* Iredale (*Proc. Mal. Soc.*, vol. 13, pts. 1 and 2, p. 34, 1918).

Cominella zealandica (Reeve, 1846). [P. 390]

This shell is not known to New Zealand collectors, and should be rejected at present as probably exotic. Iredale has withdrawn his record of *C. costata* (Q. and G.) (*Proc. Mal. Soc.*, vol. 13, pts. 1 and 2, p. 34, 1918), while Hedley has placed *Cominella quoyi* (Kiener) as probably a juvenile of *Pollia undosa* (L.) and therefore not Neozelanic (*N.Z. Journ. Sci. and Tech.*, vol. 3, no. 1, p. 55, 1920).

Cominella campbelli (Filhol, 1880). [P. 382]

Iredale suggested, and Cooke afterwards proved by means of the radulae, that the Magellanic Euthrias belonged properly to *Cominella* s.l. (*Proc. Mal. Soc.*, vol. 13, pts. 1 and 2, p. 33. 1918). This, however, is only in a very broad sense; although *campbelli* and its congeners have the superficial appearance of the "*costata*" group of Cominellids, they lack the deep anterior sinus and corresponding strong fasciole. Such forms as *plumbea* Philippi, *magellanica* Philippi, *fuscata* Bruguiere, *rosea* H. and J., *campbelli* Filhol, etc., have a uniformity of texture, appearance, and shell formation that demands separation from *Cominista* proper. *Pareuthria* Strebel, 1905 (*Zool. Jahr.*, Bd. 22, Heft 6, p. 600) proposed for *fuscata* Brug. should be used generically for these forms; the series may be derived from *Cominista* (or *vice versa*), but has by now become considerably differentiated in virtue of a subantarctic habitat.

Zephos otagoensis n. sp. (Fig. 81).

Shell small, rather elate, with strong axial and spiral sculpture. Apex of two smooth and glossy whorls, flatly dome-shaped, quite symmetrical; the pullus very minute, rapidly enlarging to the swollen next whorl; well marked off. Fourteen vertical and strong axial ribs per whorl (interstices a little wider), extending over whole shell, but weaker on shoulder and base. Numerous fine threads on shoulder: six strong spiral chords per whorl between shoulder and lower suture, ten on body-whorl, cords flatly rounded, with narrow interstices except on base where lowest two have wide spaces on either side traversed by fine interstitial threadlets. Spire more than 1½ times height of aperture. Whorls shouldered at upper ¾, the

angle bluntly convex; shoulder narrowly concave, lightly convex and cut in below. Suture linear, distinct, undulated by axials. Aperture shortly pyriform, angled and narowly channelled above, open below in a short oblique canal, deeply and narrowly notched behind. Outer lip thin and sharp, contracted at shoulder; inner lip a narrow distinctly limited milk-white glaze. Pillar straight, a trifle excavated above, with a strong narrow groove, and below it a raised narrow ridge bordering the canal. Fasciole narrow, raised, smoothish, margined anteriorly by a low sharp carina. Colour pure white.

Height, 18.5 mm.; diameter, 8 mm.

Locality,—off Otago Heads in 50 fathoms.

More elate and with a less angular shoulder than *Fax tenuicostatus* (Ten.-Woods); ornament also differs in details. For a note on this shell, and also the proposal of the genus *Zephos*, see Finlay, *Trans. N.Z. Inst.*, vol. 56, pp. 239, 240, 1926. No authentic specimens of Iredale's genus *Fax* have been available to permit of comparison between the two genera, and the present species may belong to *Fax* rather than to *Zephos*.

Pisania reticulata A. Adams, 1855. [P. 392]

This shell, which Iredale has renamed *Fusus mestayerae* (1915, p. 466), may be retained in the fauna at present. Only juvenile specimens seem to have been found in New Zealand, but Mr. Powell informs me that his juveniles from Whangaroa match well with Tasmanian examples of *mestayerae*.

Genus **Cantharus** Bolten, 1798. [P. 393]

This has no Neozelanic representative. Iredale has stated that, of the two groups *Tritonidea* and *Cantharus* used by Suter, the latter is preferable for both New Zealand forms, but is antedated by *Pollia* Sowerby, 1834 (1915, p. 466). However, neither of the two species recorded by Suter can be regarded as congeneric with *Triton undosus* Lamk., the type of *Pollia*, and one of them, *T. fuscozonata* Suter, has already herein been referred to the subgenus *Evarnula* nov. of *Buccinulum*. The other, *Tritonidea colensoi* Suter has a Tertiary ancestor in *T. acuticingulata* Suter (*N.Z. Geol. Surv. Pal. Bull. No. 5*, p. 35, 1917), which I name as type of a new genus *Zeapollia*, erected for these two shells, and for the Australian Tertiary *Ricinula purpuroides* Johnston (*Proc. Roy. Soc. Tas.* for 1879, p. 33) from the Table Cape beds (Janjukian), which is very close to *acuticingulata*. The two other Tertiary species referred by Suter to *Tritonidea*, viz., *T. compacta* Suter and *T. elatior* Suter (*loc. cit.*, pp. 35, 36) have been united by Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 503, 1924) and are now placed in *Evarnula* nov. (*vide antea*).

Latirus (*Peristernia*) *neozelanicus* (Suter) (*vide* Allan, *Trans. N.Z. Inst.*, vol. 56, p. 341, 1926) and *Latirofusus optatus* M. and M. (*l.c.*, vol. 54, p. 123, 1923) both need new generic locations but cannot be discussed at present.

Alectrion fasciata (Lamarck, 1822). [P. 397]

Eliminate this from the Neozelanic fauna. Records that have been made of this shell probably refer to what E. A. Smith has

recorded (*Brit. Antarctic "Terra Nova" Exped.* 1910; Moll., p. 85, pl. 1, fig. 28, 1915) from 11-20 fathoms near North Cape, New Zealand, as *Arcularia coronata* var., citing *Buccinum coronatum* Bruguiere, 1789 as the prime entry. As Bruguiere's name is invalid through preoccupation by Martyn, I propose to name the New Zealand shell figured by Smith *Nassarius aoteanus* nov.

As regards "*Alectrion suturalis* subsp. *Dunkeri* Suter, 1908" [P. 398], Iredale has commented on the identification, (1915, p. 467), and doubtfully regarded Suter's shells as *N. spiratus* A.Ad., noting, however, that the diagnosis seemed to refer to a shell of the "*glans*" group. Powell and La Roche have collected one or two specimens, and these prove to be of the "*glans*" type, not like *spiratus,* but close to *particeps* Hedley. The name *dunkeri* must be dropped; it is merely a new name for *Nassa intermedia* Dunker and cannot be used for New Zealand shells.

Family **Muricidae.** [P. 399]

Iredale has given some account of the higher groupings in his "Commentary," but did not deal with the species. There is not very much to say when there are only three species to consider, but *Murex octogonus* Q. and G. does not occur in Australia, neither does *Trophon umbilicatus* Ten.-Woods occur in New Zealand. What Suter has called *umbilicatus* is merely a grading form of *octogonus* and deserves no recognition; the size of the umbilicus is entirely variable. I have elsewhere in this volume advocated the use of *Murexsul* Iredale (1915, p. 471) as a full genus for this and allied species and added a new species, ***Murexsul cuvierensis,*** to the Recent fauna.

In place of *Murex angasi* Crosse, a common Sydney species, *Murex eos* Hutton must be cited, nothing like *angasi* occurring in New Zealand; the resemblance between these two is so superficial that the Neozelanic shell proves to be more closely related to the Tasmanian *Murex triformis* and referable to the subgenus *Pterochelus* (=*Alipurpura,* even as Suter placed both) instead of the subgenus *Poropteron.* The reference by Iredale in the "Commentary" to the closed canal of *Murex angasi* does not apply exactly to the Sydney species, and not at all to the Neozelanic species. There is a fossil New Zealand species, however, which was even named as a *Typhis (zealandica* Hutton, *Cat. Tert. Moll.,* p. 2, 1873) on this account; it is not uncommon in the Castlecliff beds and has wide frilled varices, and the canal completely closed, thus widely differing from the Recent *eos* Hutton, though Suter stated of the latter species that "This is *Typhis zealandica* Hutton." For this shell, Hutton's *zealandica* must of course be revived; *eos* does not seem to occur fossil, nor *zealandica* Recent. Curiously enough, the "Miocene" form (undescribed) is again of the *eos* style, with narrow shell and open canal. I present figures of both *eos* Hutton (Fig. 55) and *zealandica* (Hutton) (Fig. 56) in order that they may be contrasted.

Genus **Trophon** Montfort, 1810. [P. 404]

The comments necessary on this group more than make up for the little that could be said of the Murices.

Under this genus name Suter has arranged:—

Subgenus *Trophon*
T. ambiguus (Philippi, 1844).
T. rugosus (Q. & G., 1833).
Subgenus *Xanthochorus*
T. cheesemani (Hutton, 1882).
T. patens (H. & J., 1854).
T. squamatus (Hutton, 1878).
Subgenus *Kalydon*
T. aucklandicus (E. A. Smith, 1902).
T. convexus Suter, 1909.
T. corticatus (Hutton, 1873).
T. curtus Murdoch. 1905.
T. erectus Suter, 1909.
T. inferus (Hutton, 1873).
T. paivae (Crosse, 1864).
T. plebejus (Hutton, 1873).
T. waipipicola Webster, 1906.
Subgenus *Trophonopsis*
T. bonneti Cossmann, 1903.
T. crispulatus Suter, 1908.
T. pusillus Suter, 1907.

Before dealing with any of the species, one must dismiss the genus name *Trophon*. Though very superficially the species *ambiguus* is Trophonoid, actual comparison shows many differences; the radula figured by Suter, however, proves that the likeness must be minimised, since it is very different from the true Trophonoid radula, while the embryos of the two forms are strikingly dissimilar.

The subgeneric names *Xanthochorus* and *Trophonopsis* must also be eliminated as having nothing to do with Neozelanic shells.

To the Neozelanic fauna must be added what Hedley has determined as *Trophon albolabratus* Smith from Macquarie Island (1916, p. 60)* and *Trophon mortenseni* Odhner, described from Auckland Island (1924, p. 39). I have not seen either of these, but would place both at present in the *ambiguus* group. *Vitularia candida* H. & A. Adams *(Proc. Zool. Soc. (Lond.)*, p. 430, 1863) included by Suter as a synonym of *T. ambiguus* (Phil.) proves from examination of the type (fide T. Iredale) to be an American, not a Neozelanic shell.

Iredale, in his "Commentary," made three emendations in this group; *Trophon stangeri* Gray, 1843 in place of *T. rugosus* Q. & G. (preoccupied); *Xymene* gen. nov. for *Fusus plebejus* Hutton and its congeners; and *X. quirindus* nom. nov. for *Trophon paivae* Suter, not of Crosse. A careful study of the group suggests many further alterations.

The description of *T. stangeri* does not read at all well, but the figure cited seems sufficient to determine the species as the one customarily so called—though it may be noted that Hutton was dubious of the identity and described the so-called *stangeri* as a new species, *Polytropa retiaria (J. de Conch.*, p. 20, 1878).

Iredale wrote that "Suter's description does not apply to the types of *paivae* Crosse (=*recurvus* Philippi) nor *hanleyi* Angas, all of which I have examined in connection with this note." Suter's description, however, does not exactly apply to the Neozelanic shell, as it includes characters belonging to the Australian species and foreign to Neozelanic specimens. On the other hand, the words

*Hedley compares this species with *ambiguus* but does not report upon the apex. *T. albolabratus* Smith is a Kerguelen species and probably a true *Trophon*, while examination of the Macquarie Island species would, I think, demonstrate the presence of a conic polygyrate embryo as in *ambiguus*, so that this name must be queried.

"protoconch of two axially finely costate whorls, the nucleus small, pointed," do not apply to either Australian or Neozelanic forms, so that the diagnosis seems to be an indeterminate mixture; it is known that Suter was in the habit of drawing up conglomerate descriptions. At the time Iredale wrote, Suter's plates had not appeared, but the figure there given appears to be of an Australian shell. Under the circumstances I regard Iredale's *quirindus* as covering the Australian *paivae*+*hanleyi*+the New Zealand shell, and certainly not applicable to the New Zealand shell alone and would therefore drop it as indeterminable. For the Australian *hanleyi* group Iredale has proposed the name *Bedeva* (1924, pp. 181, 273); this genus does not occur in New Zealand.

The type tablet of *Polytropa squamata* Hutton has three shells affixed to it, in the manner indicated by Suter's figures ("Atlas," pl. 19, fig. 3). One of the shells (the uppermost of Suter's figures) is a specimen of *T. stangeri* Gray, while the other two are the commonly accepted *squamata,* reputedly from Dunedin Harbour; how the north Cookian *stangeri* came to be included in the same lot is inexplicable if the locality is correct. To save confusion I here select the centre specimen (middle one of Suter's figures) as lectotype of Hutton's species. The radula of the species has not been investigated, but it is inseparable in shell characters from *Lepsiella,* being evidently the Neozelanic representative of the Tasmanian *L. vinosa aurea* Hedley, just as the northern *L. scobina* is an ally of the Peronian *L. botanica* Hedley. While touching on *L. scobina,* one may note the record of this Cookian form from an isolated patch of rocks in Dunedin Harbour, a curiously anomalous occurrence (Finlay, *Trans. N.Z. Inst.*, vol. 55, p. 518, 1924).

Trophon patens (H. & J.) is a puzzling form. Conchologically it is inseparable from *squamata* Hutton, and even seems to grade into it; there are no features in the apex, aperture, or shell which would serve for generic distinction, yet *squamata,* as has just been noted, is apparently a *Lepsiella,* while the radula figured by Suter for *patens* is Trophonoid. Since Suter, however, examined a wrong radula in several other cases, it is just possible that he did not have a *patens* radula at all, and as the shell agreement is so close, one may at present await confirmation or rejection of Suter's evidence, and temporarily locate both species in *Lepsiella.* It is of course quite possible that similarity in shell characters should once again cover a different dentition, and the apices of *Trophon* and *Lepsiella* are too much alike for ready distinction; if *patens* does prove to have Trophonoid rather than Thaitid affinities, it may be possible to associate it with *T. cheesemani* (Hutton). The examination of the radula in this and many other New Zealand species is a matter of importance and urgency, and may be recommended to the zoological student as a piece of work of great value and promise.

Euthria aucklandica Smith, 1902 has been referred by Suter to *Trophon* on account of the dentition; but here again it is questionable whether he examined the right shell. Suter's "*aucklandicus*" is probably a very different thing from Smith's type, which is possibly the same as "*Euthria lineata* var. *pertinax*" von Martens from the

same locality. In that case "*Trophon aucklandicus* Suter" would become available for the form described and figured by Suter in the "Manual," so that in the absence of certain knowledge of Smith's type, the problem would become complex and annoying. Fortunately, however, we can dispose of an awkward dilemna by regarding Suter's name as indeterminable. This is made possible on account of several factors, as follows. Auckland Island specimens differ specifically from mainland shells, and though Suter may not have had topotypes of Smith's species, he certainly included Preservation Inlet and Campbell Island shells in the species, as these localities are mentioned by him. The diagnosis is thus a compound one, covering features characteristic of both Forsterian and Rossian forms. The figure does not seem to be taken from an Auckland Island shell, but neither is it typical of mainland forms, and as it does not agree with his diagnosis (spirals too few, and this is a specific character) and the original is not preserved, I consider the correct course is to neglect it and dispose of Suter's name. This vexed problem cannot be entirely settled till Smith's type is reported on, but at present one may advocate the dismissal of the name *aucklandica* altogether—Smith's use being a probable synonym, Suter's indeterminable. Iredale intended his *quirindus* to apply to this style of shell, and as that name has been shown to be also indeterminable, I now put forward a new name altogether (*turbator* n. sp., see later) and thus place this common shell on a more satisfactory footing.

The type lot of *Trophon curtus* Murdoch contains specimens of a perfectly distinct species, which are responsible for parts of the diagnosis such as "very often both whorls (of protoconch) are strongly keeled." True *curtus* never has strong apical keels, the embryo being only sub-shouldered, with traces of a lower angle near its end. The species confused with it, though always distinct in apex and ornament, is congeneric with it, and very close to the shell that Suter three years later described as *Mangilia devia* from the Snares Islands in 50 fathoms.

Trophon bonneti Cossmann is an Upper Pliocene fossil, and does not occur Recent, Suter's records being based on new species. The union of *T. ambiguus pumila* Suter with this species is quite wrong, Suter's shell having nothing to do with either *ambiguus* or *bonneti*. It is a very variable shell and often simulates the *bonneti* type of sculpture, but has a radically different embryo and belongs to a widely removed group. It is, in fact, synonymous with my *Xymene robustus* (*Trans. N.Z. Inst.*, vol. 55, p. 520, 1924), over which it has priority, Suter's figure and identification of his shell with *bonneti* leading me to believe that *pumila* was of the *ambiguus* group; topotypes since obtained have demonstrated its true affinities.

The remark " Allied to the Pliocene *T. gouldi* Cossmann " which is added to the description of *T. crispulatus* should, of course, be transferred to the next species, *T. pusillus*. *Crispulatus* has nothing whatever to do with *gouldi*, while *pusillus* is very close. It may be noted that Powell has lately figured *pusillus* for *curtus* (Bucknill, 1924, Pl. 8, fig. 6). This appears to be the only marked error in this useful little book, though it is a pity the author has so assiduously followed the " Manual," for the resulting bad nomenclature robs the

book of some of its worth. The value of the work lies in Powell's illustrations, which are fine and natural, taken from authentic New Zealand specimens (the originals of which are preserved mostly in his own collection), and forming a far better guide for the casual collector than the "Atlas" or Moss's unpretentious work.

Marwick has lately fallen into error in a discussion of the validity of the name *gouldi* for the Petane shell called *crispus* Gould by Hutton; I have gone into the matter elsewhere in this volume and advocated the retention of the name *gouldi* for the New Zealand shell.

Trophon virginalis Suter is a species that seems to have fallen into oblivion since it was described in 1913 (*Rec. Cant. Mus.*, vol. 2, pt. 1, p. 58) along with *Siphonium planatum* Suter. Only list records of the latter appear elsewhere, and nowhere with a reference, but of the former not even these are available, and the name seems to have been forgotten entirely by its proposer and all other workers. The unique type specimen, which by the kindness of Mr. Speight I have been able to examine, is from Cape Maria van Diemen and has lost the protoconch and part of the outer lip. Enough remains, however, to show that it is a valid species, and that it belongs to the genus *Galfridus* Iredale (1924, p. 271), thus remaining in the *Muricidae.* It differs from the Sydney *G. speciosus* (Angas) mainly in much finer spiral sculpture; the state of preservation and appearance are exactly the same as other shells known to be from Cape Maria van Diemen.

The association now proposed contains many novelties, in both names and groupings, but it is based on lineage and nuclear characters, and is the result of long study of ample type and topotypic material. As in every other difficult group studied, I regard the embryo (taken in conjunction with build of shell and style of ornament) as of the highest importance in indicating true groups. One finds numerous cases of convergence, almost identical-looking shells having diverse apices, so that an attempt to classify Trophons without recourse to embryonic features leads at once to error; if, however, nuclear characters are used as a basis for division of the Recent forms, it is at once seen that the fossils fall readily into lineage and indicate that natural grouping has been accomplished.

Neozelanic Trophons may be primarily divided into two large groups, according to whether the apex is

(a) of more that two whorls, conic and mamillate, symmetrical, the nucleus central and minute, or

(b) of 1-2 whorls, papillate, asymmetrical, the nucleus lateral and large.

The first division contains the groups typified by *ambiguus, plebejus,* and *pusillus;* the second, those represented by *turbator* n. sp., *convexus, curtus, crispulatus,* and *crassiliratus,* also *Buccinum geversianum* Pallas, the genotype of *Trophon* s. str. The genera that I suggest, and the species grouped under them, are as follows (I give references only where they are not directly obtainable from the "Manual"). As before, a name in square brackets indicates an exclusively Tertiary form.

ZEATROPHON n. gen. Type: *Fusus ambiguus* Phil.
Fusus ambiguus Phil., 1844.
" *Trophon albolabratus* " Hedley, 1916.
[*Trophon (Trophonopsis) bonneti*] Cossmann, 1903.
Trophon mortenseni Odhner, 1924.
(?) [*Trophon huttoni*] Murdoch, 1900 (*T.N.Z.I.*, vol. 32, p. 221.
Several new species from deep water in both Islands.

XYMENE Iredale, 1915. Type: *Fusus plebejus* Hutton.
Fusus plebejus Hutton, 1873.
Fusus inferus Hutton, 1873.
[*Trophon expansus*] Hutton, 1883 (*T.N.Z.I.*, vol. 15, p. 410).
[*Cominella drewi*] Hutton, 1883 (*T.N.Z.I.*, vol. 15, p. 410).
[*Trophon* (*Xanthochorus*) *pulcherrimus*] Suter, 1917 (*Pal. Bull. No. 5*, p. 38).
[*Cominella monilifera*] Hutton, 1885 (*T.N.Z.I.*, vol. 17, p. 327).

XYMENELLA n. gen. Type: *Trophon pusillus* Suter.
Trophon pusillus Suter, 1907.
[*Trophon gouldi*] Cossmann, 1903 (*Essais de Pal. Comp.*, livr. 5, p. 54).
[*Cymatium suteri*] Marshall and Murdoch, 1921 (*T.N.Z.I.*, vol. 53, p. 80).
[*Trophon (Kalydon) lepidus*] Suter, 1917 (*Pal. Bull. No. 5*, p. 37).
[*Trophon* (*Kalydon*) *minutissimus*] Suter, 1917 (*Pal. Bull. No. 5*, p. 37).
Many new Tertiary species; most of the " Miocene " forms belong to this group.

PARATROPHON n. gen. Type *Polytropa cheesemani* Hutton.
Polytropa cheesemani Hutton, 1882.
Fusus stangeri Gray, 1843.
Undescribed ancestral species.

AXYMENE n. gen. Type *Axymene turbator* n. sp.
Axymene turbator Finlay, 1927.
Trophon erectus Suter, 1909.
Fusus corticatus Hutton, 1873.
Fusus traversi Hutton, 1873.
Trophon waipipicola Webster, 1906.
Trophon ambiguus pumila Suter, 1899 (= *Xymene robustus* Finlay).
[*Trophon murdochi*] Marwick, 1924 (*T.N.Z.I.*, vol. 55, p. 198).
New Pliocene species.

LENITROPHON n. subgen. Type: *Trophon convexus* Suter.
Trophon convexus Suter, 1909.
An ancestral new Pliocene species.

COMPTELLA n. gen. Type: *Trophon curtus* Murdoch.
Trophon curtus Murdoch, 1905.
Mangilia devia Suter, 1908.
New Recent species.

TEREFUNDUS n. gen. Type: *Trophon crispulatus* Suter.
Trophon crispulatus Suter, 1908.
Mangilia quadricincta Suter, 1908.
Leucosyrinx cuvierensis Mestayer, 1919 (*T.N.Z.I.*, vol. 51, p. 133).
New Recent species.

MINORTROPHON n. subgen. Type: *Daphnella crassilirata* Suter.
Daphnella crassilirata Suter, 1908.

The differences between *Zeatrophon* and *Trophon* s. str. have already been commented on. *Xymene* is a peculiarly distinct little group whose members have a uniform style of shell and gemmate spiral sculpture, the early whorls with low flattish cords cut up into beads, and with generally no distinct axial ribs, whereas *Xymenella* has the post-embryonic whorls strongly bicarinate, with pronounced axial ribs. Almost the whole of the "Miocene" forms belong to this latter group, which, except for *Terefundus,* contains the smallest Trophonoids. The apex of *Paratrophon* has not been seen, hence I may have erred in associating these two species together; they are both aberrant forms, and do not associate well, but the build of shell seems to be essentially the same in both *stangeri* and *cheesemani,* and, pending examination of unworn apices, it is preferable to place them together. *Axymene* and *Comptella* have a conspicuous feature in the strong oblique cord traversing the neck of the canal, but *Comptella* has a regular fenestrate ornament, with thin distant spirals and axials, and a very short canal, while *Axymene* consists of elate shells with strong coarse axial ribs and rather irregular spirals, the canal being pronounced. *T. pumila* and *T. murdochi* are not typical forms of *Axymene,* but may, on account of their apices, be left here temporarily; the position of *T. huttoni* is also insecure as no perfect apex has been seen, but it probably belongs to *Zeatrophon. Lenitrophon* may be treated as of subgeneric rank under *Axymene,* as the apices are essentially similar; the shell formation differs in its gently convex unshouldered whorls and absence of stronger cord on canal. *Terefundus* is a very distinct group, characterized by minute size of shell, few and thin spiral cords with axial laminations, and totally smooth base and canal. *Minortrophon* has the same small shell and smooth base, but the facies of the shell is otherwise quite different, there being only heavy broad revolving cords, and an almost obsolete canal. The diversity of locations used for the species of *Terefundus* sufficiently attests the distinctness of the group. How *Leucosyrinx cuvierensis* Mest. and *L. thomsoni* Mest. could have been placed together in this genus, with the remark that the nearest ally of the one is the other, is beyond comprehension; they are totally unrelated. Miss Mestayer remarked that "they do not seem to be very closely allied to any other New Zealand species, either Recent or fossil." The danger nowadays of systematic work without a knowledge of the fossil faunas (and *vice versa*) is exemplified in this statement, for both forms are *very* closely related to previously described New Zealand species, the latter, in fact, being a synonym of *Turris nexilis bicarinatus* Suter, while the former is barely separable from *Mangilia quadricincta* Suter.

Axymene turbator n. gen and sp. (Figs. 127, 128).

Shell small, dark coloured. Apex small, papillate, of 1½ smooth whorls, the nucleus globose and asymmetric. 14-16 axial ribs per whorl, faint and thin on shoulder, thence prominent to lower suture (interstices narrow at bottom, subequal to ribs at top of ribs), rapidly vanishing on base. Four spirals on penultimate whorl below shoulder (which is smooth), nine on body whorl, cords thickish (with subequal interstices), undulated and faintly thickened by axials, the ninth on neck of canal, very prominent. Faintly lamellose growth-lines over the whole surface. Spire subequal to aperture with canal, outlines stepped but straight. Whorls strongly shouldered at upper third, shoulder lightly concave, straight below. Suture inconspicuous, margined below by a pronounced swelling, above by the lowest cord. Aperture trapezoidal, widely angled above, produced below into a moderately long narrow canal, flexed a little to left, not notched at base. Outer lip thin and sharp, vertical in middle, straight and oblique in opposite directions at shoulder and base. Inner lip defined as a narrow glaze. Pillar subvertical, twisted near inception of canal and thence narrowing to a long fine point. Fasciole weak, smooth except for growth-lines. Colour sienna-chocolate, outside with greyish tints, inside chocolate, pillar touched with white.

Height, 12.5 mm.; diameter, 6 mm.

Locality,—Dunedin Harbour, under stones at low tide.

Genus **Vesanula** Finlay.

For a curious Middle Tertiary shell of both Trophonoid and Fusid affinities, *V. chaskanon*, I introduced this genus name (*Trans. N.Z. Inst.*, vol. 56, p. 245, 1926), stating that *Pagodula vegrandis* M. & M. (*l.c.*, vol. 54, p. 124, 1923) "is superficially similar, but the embryo is radically different." This conclusion was based on an abnormal specimen, and study of further material of both species and of *V. tegens* (Hutton) (*l.c.*, vol. 9, p. 594, 1877) allows me to correct the mis-statement, and give a better description of the embryo of *Vesanula*. All the species have a two-whorled protoconch, smooth and glossy, the second whorl somewhat inflated and ending in a distinct curved varix, followed by a short brephic stage of similar but distant and stronger varices before there arises the median keel with its strong triangular open spines. There is some variation, however, in the initial whorl; in *chaskanon* and *tegens* it is minute, slightly asymmetrical, and very depressed, quite tiny in comparison with the much inflated second volution, in *vegrandis* it is much more loosely coiled, suberect and somewhat papillate, the second whorl relatively much less swollen. Nevertheless, there seems to be no fundamental difference shown, and the shells are so similar in facies that they can safely be grouped together. This is welcome, as it will remove the extra-limital genus *Pagodula* from New Zealand faunal lists. I cannot help thinking that *Columbarium maorum* M. & M. (*Trans. N.Z. Inst.*, vol. 54, p. 127, 1923) would be better placed in *Vesanula;* the characteristic aperture is unfortunately missing, but the embryo, though described as lightly carinated, is nothing like the large bulb of the Recent *C. suteri* Smith or the Australian Tertiary forms such as *acanthostephes* (Tate). *Vesanula* seems, on

the whole, to be better placed near *Xymenella* in the Trophonidae than near *Columbarium* in the Fusidae.

Genus **Typhis** Montfort, 1810. [P. 420]

Suter was able to record only a damaged and specifically indeterminable specimen of this genus from 110 fathoms off Great Barrier Island, but Miss Mestayer has now definitely added it to the fauna by describing *T. pauperis* (*Trans. N.Z. Inst.*, vol. 48, p. 127, 1916) from 60 fathoms Poor Knights Is., and 30 fathoms Hauraki Gulf. The Tertiary species *T. hebetatus* Hutton has lately been recompared with Australian material (Marwick; *Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 328, 1924), and its asserted identity with *T. maccoyi* T.-W. decided to be well founded. I have added a second Tertiary species, *T. francescae* (*Trans. N.Z. Inst.*, vol. 55, p. 465, 1924).

Thais haustrum (Martyn, 1784). [P. 422]

In his "Commentary" Iredale proposed to use for this genus *Haustrum*, of Perry, 1811, but *Haustrum* was a Humphrey name, published in 1797 in the *Museum Calonnianum*, where the only recognisable constituent of the genus is *Buccinum persicum* Linné (teste T. Iredale), so that Hutton's genus name *Lepsia* can be reverted to.

This species has been denounced as an oyster-borer (Hedley, *N.Z. Journ. Sci. & Tech.*, vol. 2, No. 6, p. 366, 1919).

Thais succincta (Martyn, 1784). [P. 423]

This species was localized as from New Zealand, but contemporary authorities recognized that it came from Botany Bay, New South Wales. When series of specimens are examined, this is very definite, as the form figured by Martyn is typical of the common Sydney shells and disagrees with the Neozelanic type. Several species prove to have been confused under the above name, and the Neozelanic species must bear the name *scalaris* Menke 1829 (*Verz. Conch. Samml. Mals.*, p. 33). New Zealand shells differ at sight from Sydney specimens, especially when juveniles are compared, in relatively much more capacious aperture, quite differently flexed pillar, and shorter and broader spire, besides differences in detail of sculpture.

The apex of *N. lacunosa* Bruguière needs examination to determine its nature; there is nothing to show at present that it is really Neothaitid, i.e., sinusigerid, horny, sharply conic, polygyrate, swollen at its base, and set somewhat obliquely on the shell.

Powell has recorded (*N.Z. Journ. Sci. & Tech.*, vol. 4, p. 205, 1921) a large specimen (36 mm. high) of *Lepsiella scobina rutila* (Suter) from Whangarei.

Thais tritoniformis (Blainville, 1833). [P. 424]

The correct name is *Agnewia tritoniformis*, but it must be noted that Suter gives no authority for the two localities he mentions, "Bay of Islands; Cook Strait," referring to Justice Gillies's introduction of it to the Neozelanic fauna. Mr. La Roche, of Auckland, has two specimens found by himself at Whangaroa; I have examined

these, and here figure one of them (Fig. 32), but as the species is a somewhat variable one more Neozelanic examples must be studied before a safe discrimination can be made. One may therefore admit it doubtfully to the fauna. The specimens possibly came from Australia in ballast; exotic shells have occasionally been reported alive in New Zealand waters, e.g. *Murex ramosus* L. (Moss; *Beautiful Shells of New Zealand*, p. 16, 1908) and *Conus marmoreus* L. (Mestayer; *N.Z. Journ. Sci. & Tech.*, vol. 1, p. 102, 1918: *Ericusa sowerbyi* Kiener also reported from a dead shell). These have, of course, no just claim to inclusion in the Neozelanic fauna.

Family **Cancellariidae.** [P. 429]

This has as yet only one Recent representative, but I have in my collection undescribed new species belonging to several genera.

The fossil species have considerably increased in number, and the following new genera have been proposed for them: *Oamaruia* Finlay (for *Admete suteri* M. & M.; *Trans. N.Z. Inst.*, vol. 52, p. 132, 1920) (*Trans. N.Z. Inst.*, vol. 54, p. 514, 1924), *Inglisella* Finlay (for *Ptychatractus pukeuriensis* Suter; *N.Z.G.S. Pal. Bull. No.* 5, p. 26, 1917) (*l.c.*, p. 513), *Maorivetia* Finlay (for *Turbinella brevirostris* Hutton; *Trans. N.Z. Inst.*, vol. 9, p. 596, 1877) (*l.c.*, p. 513), and *Procancellaria* Wilckens (for *P. parkiana* Wilck.; *N.Z.G.S. Pal. Bull. No.* 8, p. 21, 1922); the last is a Cretaceous genus and is a very doubtful member of the family. *Inglisella* seems to be allied to the Recent Australian genus *Microsveltia* Iredale (for *M. recessa* Iredale) *Rec. Austr. Mus.*, vol. 14, p. 265, 1925) and includes, besides the type, *cincta* (Hutton) (*Trans. N.Z. Inst.*, vol. 17, p. 327, 1885), *anomala* M. & M. (*l.c.*, vol. 52, p. 132, 1920) and the Australian Tertiary *etheridgei* (Johnston) and probably *caperata* (Tate). *Pepta* Iredale (*l.c.*, p. 266) another Recent Australian genus, proposed for *Admete stricta* Hedley, and including the Tertiary *turriculata* Tate, has no Neozelanic representative. Neither is *Cancellaria* proper represented in New Zealand, though *Cancellaria scobina* Hedley and Petterd, which Iredale has noted (1924, p. 262, and 1925, p. 266) should be "removed from *Admete* back to *Cancellaria* s.l." is quite like some members of the series *lacunosa* Hutton (*Trans. N.Z. Inst.*, vol. 17, p. 320, 1885), *maorium* M. & M. (*l.c.*, vol. 53, p. 82, 1921), *ovalis* Marshall (*l.c.*, vol. 50, p. 269, 1918), and *hampdenensis* M. & M. (*l.c.*, vol. 54, p. 124, 1923), for which the generic name *Bonellitia* Jousseaume—apparently a reasonable location—is at present in use in New Zealand. The Australian *Trigonostoma* series is represented in the New Zealand Tertiary by *T. waikaiaensis* and *christiei* Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 466, 1924). *Maorivetia* is at present restricted to the type species, while *Oamaruia* includes one New Zealand species (though others are known to me), i.e., *O. suteri* (M. & M.) the genotype, and several Australian species, *ptychotropis* and *tatei* (Cossmann) (= *gradata* Tate; see nomenclatural note elsewhere in this volume), and the Recent *pergradata* (Verco). The list of New Zealand Tertiary species is completed by the addition of three doubtfully located forms, *Aphera (?) scopalveus* Finlay (*Trans. N.Z. Inst.*, vol. 56, p. 246, 1926), *Uxia (?) marshalli* Allan (*l.c.*, p. 342), and "*Admete*" *cristata*

Marwick (*l.c.*, p. 323), the last named probably does not belong to this family.

Admete traillii (Hutton, 1873). [P. 429]

The reference to the genus *Admete* is indefensible. Suter's description, "Protoconch of 1½ smooth and convex whorls, the nucleus globular....Columella vertical, with 3 low rounded and oblique plaits" should be contrasted with that of the type of *Admete*, with its sculptured complex protoconch and its smooth columella. I propose the new generic name *Zeadmete*, naming *Cancellaria trailli* Hutton as type.

Family **Pyrenidae**. [P. 430]

The forms referred to this family by Suter are placed in four genera, *Mitrella, Anachis, Alcira,* and *Atilia.* All these four names must be dismissed, and most of the species redistributed. Suter's basis of classification—length of the canal and the presence or absence of an oblique plait at the base of the pillar is useless as regards Neozelanic species; Suter himself could not use it, for there are several "Mitrellas" among his "Alciras" and *vice versa.*

Before rearranging the forms into more natural groups, however, it is best to deal with three specific names that call for rejection; these are *Alcira sanguinea, A. inconstans,* and *Atilia biconica.*

Topotypes of *Alcira sanguinea* Suter agree absolutely with topotypes of *Mitrella rosea* (Hutton); as evinced by his generic location, Suter saw a basal plait in the Bounty Island shells, and therefore distinguished them from *rosea* which he had placed in *Mitrella;* but all specimens of *rosea* show a strong basal plait, while Hutton's original location in *Obeliscus* is sufficient evidence that he had not missed it.

Suter (*Trans. N.Z. Inst.*, vol. 38, p. 329, 1906) renamed *Columbella varians* Hutton *C. inconstans* nov., and (wrongly) changed *Lachesis sulcata* Hutton to *Columbella huttoni* nov. (*Index Faunae N.Z.*, p. 72, 1904), but the type material of the former—from the Upper Pliocene—is inseparable as a species from the two poor type specimens of the latter; *sulcata* has many years' priority. The confusion seems to have begun when Murdoch (*Trans. N. Z. Inst.*, vol. 37, p. 223, pl. 7, fig. 12, 1905) figured a Whangaroa shell which he took to be *huttoni,* i.e. *sulcata;* it hardly resembles it and belongs to a different group, but nevertheless this is the interpretation and illustration given to Hutton's species in the "Manual" [p. 440] and "Atlas" [Plate 20, fig. 1]. Murdoch at the same time gave a good description of his specimens, which represent a distinct form, so I rename it after him (see under *Paxula),* selecting a type here figured (Figs. 60, 61) from the same locality, in the Finlay collection.

Suter described *Atilia biconica* from Hauraki Gulf, in 25 fathoms, remarking that "The two specimens at my disposal for drawing up the above diagnosis do not appear to be quite full grown." This, no doubt, was the reason for a curious blunder, for the specimens are juveniles of the shell he had described three pages previously as *Mitrella pseudomarginata* from the Bay of Islands; I have specimens dredged in 25 fathoms in Hauraki Gulf. i.e., topotypes of *biconica.*

Mitromorpha suteri Murdoch was referred to *Alcira* by Suter; this was probably an accident as the shell has no plait on the pillar; however it has spiral sculpture. It is not a Pyrenid, and Murdoch's original location was quite good, considering what was known of *Mitromorpha* at that time; it is now removed again to the *Turridae*, and will be dealt with later.

Lumping all the Mitrellas, Alciras, and Atilias together, and resorting, I suggest the following grouping:—

Paxula n. gen. Type *Columbella paxillus* Murdoch.

With the type I associate *C. transitans* Murdoch, *Mitrella leptalea* Suter, *M. subantarctica* Suter, and *Paxula murdochi* nom. nov. for *Columbella huttoni* Murdoch, not of Suter (*vide antea*). This is a very compact little assemblage, all the members of which have a sharp straight spire, and highly characteristic aperture (well shown in Murdoch's original figures of *transitans* and *paxillus*) which has a medially inflated shortly pyriform shape, a considerably excavated pillar, twisted below, but with no trace at any stage of a plait or groove, and a very short canal flexed to the left. Specific differences in the group seem limited to variation in spiral sculpture and slenderness of shell. The range of localities given by Suter for Murdoch's *transitans* is worth noting; it probably does not reach the South Island, while the Subantarctic records refer to *subantarctica*. The Pliocene *Columbella angustata* Hutton is, however, not referable here, but is a Turrid.

Liratilia n. gen. Type: *Daphnella conquisita* Suter.

This shell and *Alcira angulata* Suter, described the following year, are extremely close specifically, though one would not guess so from the crude figures. Suter's inability to recognize his own groups is frequently evident, especially to the palaeontologist (*cf.* Marwick, *Trans. N.Z. Inst.*, vol. 56, p. 310, 1926), but more to be regretted is his habit of retouching figures to conform with his generic locations. This is a matter that must unfortunately be brought to notice as it has caused so much confusion, and it must be repeatedly stressed that generic conclusions are drawn at great risk from Suter's figures. Dr. Marwick has frequently mentioned Suter's unreliability in both generic and specific identifications and the false impression often given by his figures; the point is noted again since European authorities are accustomed to place Australasian shells from figures alone, and in the case of Neozelanic shells this leads only to confusion. A much better figure of *D. conquisita* (though of a juvenile shell) is given by Odher under the misidentification and wrong generic location of "*Prosipho chariessa*" (1924, p. 37; pl. 1, fig. 25). Odhner mentions that "it is possible that also some of the spirally lirate species of *Alcira* from New Zealand belong to *Prosipho*," and notes that Hedley has referred some Australian species there. I doubt the applicability of *Prosipho* to any Neozelanic species, but it certainly does not apply to the present Pyrenid group, which again is little like the Australian *cassandra, pallidula,* etc. A third species of *Liratilia* is *Pleurotoma* (*Leucosyrinx*) *eremita* M. and S., described from 110 fathoms off Great Barrier Island; this differs from the other two chiefly in possessing faint axial riblets on the upper whorls; it is

certainly not a Turrid. I know of the genotype as a Castlecliff fossil, but otherwise the group is so far of only Recent occurrence.

Zemitrella n. gen. Type: *Lachesis sulcata* Hutton.

Here may be grouped the remaining New Zealand Pyrenids (except those placed in *Anachis); choava, pseudomarginata, stephanophora, websteri, laevigata, rosea,* the type, and (provisionally) *Atilia daemona* Webster. There is indication that more than one shell type is included here, but there is gradation, and till the fossil forms are better known I prefer not to split further. Marshall's *Mitrella inconspicua (Trans. N.Z. Inst.*, vol. 50, p. 266, 1918) and some undescribed Tertiary species (e.g., Suter's "*Alcira* n. sp."—*N.Z. Geol. Surv. Bull. No. 20,* pp. 89, 93, 1918) belong to this group, all the members of which show an oblique plait at the base of the pillar. *Choava* has the plait subobsolete, but all the others show it strongly, especially in juvenile shells.

The Neozelanic species of *Anachis* are divisible into two groups, one containing small shells with short beak, and the other—restricted to the Tertiary—larger shells with distinct canal. Neither of these exactly matches with *Pyrene gemmulifera* Hedley (the type of *Retizafra)* which is a minute *Mitrithara*-like shell from the Capricorn group, nor with the genotypes of any of the cancellate genera outlined by Iredale in *Proc. Mal. Soc.*, vol. 12, pt. 1, p. 33, 1916. The forms of both series seem to be sublittoral dwellers of southern development, and as no other austral group is suitable I provide names.

Macrozafra n. gen. Type: *Clathurella subabnormis* Suter.

Here would also be placed the only other Recent species included by Suter, *Clathurella nodicincta* Suter. But from the series available I would maintain *Columbella saxatilis* Murdoch as a third good form, very close to *subabnormis* but apparently distinct in its higher spire, stouter shell, and narrower and less flexuous axials; described from Takapuna, it would seem to be a northerly regional representative of the Lyall Bay *subabnormis*. Suter's poor figure in the "Manual" is quite different from his original illustration, and seems to have been taken from a northern shell; when the original figure is contrasted with Murdoch's picture of *saxatilis (Trans. N.Z. Inst.*, vol. 37, pl. 8, fig. 15, 1905) the differences are at once apparent.

There is a Tertiary ancestral (undescribed) species from the "Miocene," but otherwise no fossil species of this group are known. *M. nodicincta* would seem to be very closely related to the Tasmanian and South Australian *Pyrene calva* Verco. The Australian early Tertiary *Columbella balcombensis* Pritchard (*P.R.S. Vict.*, vol. 17, N.S., pt. 1, p. 324, 1904), though also nearly allied, represents a separable group.

Antizafra n. gen. Type: *Columbella pisaniopsis* Hutton.

The type, *C. cancellaria* Hutton, *Anachis speighti* Marwick *(Trans. N.Z. Inst.*, vol. 55, p. 199, 1924), and two "Miocene" (undescribed) ancestors constitute this group in New Zealand, while *Columbella plexa* Hedley seems to be an Australian member.

Family **Volutidae** Gray. [P. 444]

Dr. Marwick has just recently published a revision of the "Tertiary and Recent Volutidae of New Zealand" *(Trans. N.Z. Inst.*,

vol. 56, pp. 259-303, 1926), in which 82 species are admitted to the New Zealand faunal lists, and the following groups proposed:—

Notoplejona for *Athleta necopinata* Suter (p. 270).
Mauia for *Galeodes maoriana* Suter (p. 271).
Waihaoia for *W. allani* Marwick (p. 274).
Teremelon for *Scaphella tumidior* Finlay (p. 279).
Pachymelon for *Waihaoia amoriaformis* Marwick (p. 281).
Spinomelon for *Lapparia parki* Suter (p. 283).
Metamelon for *Miomelon clifdenensis* Finlay (p. 285).

Fulgoraria Schumacher is dismissed altogether from this region, and *Alcithoe* used instead as a full genus. The only other previously known genus utilized is *Lyria* Gray, which I admitted to the fauna by describing *L. zelandica (Trans. N.Z. Inst.*, vol. 55, p. 470), and regarding which Marwick has remarked (p. 263), "The presence of an isolated but typical *Lyria* in Middle Tertiary (probably Oligocene) beds in New Zealand is rather surprising." Eight Recent species are allowed; seven of these are placed in *Alcithoe,* viz., *swainsoni* Marwick (new name for *elongata* Swainson, preoccupied by Solander), *larochei* Marwick (a new species from off Opotiki in 30 fathoms), *arabica* (Mart.), *jaculoides* Powell *(Proc. Mal. Soc.*, vol. 16, p. 108, 1924), *depressa* Suter, *gracilis* (Swainson), and *hedleyi* M. & S., while the eighth, Watson's *Cymbiola lutea,* is referred to *Waihaoia,* subgenus *Pachymelon,* but it is so sundered in time-occurrence from the other members of the genus, and especially the subgenus, that close affinity is doubtful. The formation of the whorls and beak, and especially of the columellar plaits is very different from that seen in *amoriaformis* and its allies. Watson says of the pillar plaits, "four not strong, equal, concealed,....very oblique teeth," *Pachymelon* has 5-6 very strong, unequal, prominently visible, not very oblique plaits; Watson's figure 3b (*Chall. Rep.*, vol. 15, pl. 15) shows the peculiar columella and general facies much better than his figure 3a, which Marwick has reproduced (*l.c.*, Pl. 63, fig. 3). I accordingly propose *Palomelon* n. subgen. of *Waihaoia* for Watson's species alone, to mark its conchological and chronological separation from the other members of that group; it is possibly not closely allied to them at all. *Waihaoia firma* was inadvertently described without locality in Marwick's paper; he has now given this as "shell-bed, Target Gully, Oamaru" (*N.Z. Journ. Sci. and Tech.*, vol. 8, no. 5, p. 304, 1926).

To Marwick's census must be added the genus *Microvoluta* Angas, 1877 (*vide antea*) with its two Neozelanic species *biconica* M. & S. (Recent), and *lincta* Hutton (Pliocene); also the extraordinary genus *Iredalina* Finlay *(Proc. Mal. Soc.*, vol. 17, p. 59, 1926), proposed for "A Volute without plaits," *I. mirabilis* Finlay, described from the unique type trawled in 40 fathoms off Otago Heads. The Australian *Ericusa sowerbyi* (Kiener) has been reported by Miss Mestayer *(N.Z. Journ. Sci. & Tech.*, vol. 1, p. 103, 1918) from the beach at Evans Bay, Wellington Harbour, but is, of course, no true member of our fauna.

Genus **Ancilla** Lamarck, 1799. [P. 450]

Ancilla, at the reference given by Suter, which is correct, is based upon the figures of Martin, "*Conch.*, 2, p. 359, t. 65, fig. 722-724."

These figures are recognized by Pfeiffer in the *Krit. Register,* 1840, p. 20 as:—fig. 722, *A. candida* Lamarck; figs. 723-4, *Voluta ampla* Gmel.=*A. cinnamomea* Lamk. No true *Ancilla* occurs in New Zealand, living or fossil; *Baryspira* Fischer, 1883 (Type: *A. australis* Sow.) is available for Neozelanic forms, but at least three groups can be determined, and as numerous additions have been made to the Tertiary list within recent years, these are here outlined. First, however, it may be noted that two Australian Tertiary species, *papillata* Tate and *subgradata* Tate, have been dismissed from the Neozelanic fauna by Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 322, 1924), an Australian species which had been confounded with the Neozelanic *A. hebera* Hutton being renamed *A. tatei* Marwick at the same time (*l.c.*, p. 319).

Baryspira Fischer, 1883 (*Man. de Conch.*, fasc. 6, p. 600) should be used generically for the Recent species *australis* and *mucronata* Sowerby, and the fossils *spinigera* and *cincta* Marshall (*Trans. N.Z. Inst.*, vol. 50, p. 267, 1918), *robusta* Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 322, 1924), *tirangiensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 324, 1926), and *waikaiaensis* Finlay (*l.c.*, p. 251). Powell has recorded (*N.Z. Journ. Sci. & Tech.*, vol. 6, p. 285, 1924) the occurrence of numerous living specimens of *mucronata* on a sandpit off Devonport, Auckland; the only instance of its having been found in the littoral zone.

Alocospira Cossmann, 1899 (*Ess. de Pal. comp.*, livr. 3, p. 92) may be employed subgenerically for the Tertiary *hebera* Hutton (*Cat. Tert. Moll.*, p. 6, 1873) and *subhebera* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 323, 1926), and perhaps the Recent *novaezelandiae* Sowerby. *Hebera* is a variable form, but many specimens show the characteristic callus and spiral ridges of the Australian Tertiary *papillata* Tate, the genotype of *Alocospira*. *Novaezelandiae* is rather difficult to place, but Iredale, in treating of Australian Recent Ancillas (1924, p. 261), has included the smooth-spired forms in *Alocospira;* there seems to be much gradation in this character, and *hebera* is frequently smooth.

Pinguispira n. subgen., type: *Ancilla* (*Baryspira*) *opima* Marwick (*Trans. N.Z. Inst.*, vol. 55, p. 200, 1924) is proposed to include the remaining species; the Recent forms *depressa* Sow. and *crystallina* Brookes (*l.c.*, vol. 56, p. 589, 1926), and the Tertiary species (besides the type) *lata* Hutton (*Trans. N.Z. Inst.*, vol. 17, p. 325, 1885) (which should not be merged in *depressa* as Suter has done), *waikopiroensis* Suter (*N.Z.G.S. Pal. Bull. No. 5,* p. 42, 1917), and *morgani* Allan (*Trans. N.Z. Inst.*, vol. 56, p. 342, 1926). This group is very distinct in its squat and inflated shell, and short and heavily thickened pillar, notably excavated and twisted anteriorly.

All the New Zealand species have been mentioned in the above summary.

Family **Marginellidae**. [P. 456]

Probably a large number of these shells will turn up in dredgings later, as Tasmania has over sixty species already listed, while New Zealand shows only fifteen. The major groupings are in a state of chaos, and Suter is to be congratulated upon attempting a scheme

of separation, though the grouping of the New Zealand forms is as confused as in the *Pyrenidae*. Suter recognises a genus *Cryptospira* of Hinds, 1844, subordinating to it a subgenus *Gibberula* Swainson, 1840. This arrangement must be reversed, but probably neither genus is correctly used. The five Australian species are very doubtful inclusions.

Odhner has added *Marginella coma* n.sp. from 50 fathoms off Cape Maria van Diemen, and the status of this form must remain in doubt till relatives turn up; it may be distantly related to *Peculator* Iredale (1924, p. 269), but is certainly no true *Marginella*. The only other addition to the Recent fauna since the " Manual " was published is *M. cairoma* Brookes (*Trans. N.Z. Inst.*, vol. 55, p. 154, 1924) from the north Cookian region. The Tertiary list, however, has been augmented considerably, and now stands as follows:—(group A), *conica* Harris (*Cat. Tert. Moll. B.M.*, p. 88, 1897), *whitecliffensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 324, 1926); (group B), *harrisi* Cossmann (*Ess. de Pal. comp.*, livr. 3, p. 88, 1899; see nomenclatural note elsewhere in this volume), *fraudulenta* Suter (*N.Z.G.S. Pal. Bull. No. 5*, p. 42, 1917), *aveniformis* Marshall (*Trans. N.Z. Inst.*, vol. 51, p. 230, 1919); (group C), *dubia* Hutton (*Cat. Tert. Moll.*, p. 8, 1873; from Broken River, Lower beds; "Outline like *M. kirki* Marwick, but much larger and stronger, body whorl more inflated, and spire broader and lower "—Marwick, *in litt.*), *hectori* Kirk (*Trans. N.Z. Inst.*, vol. 14, p. 409, 1882), *kirki* Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 324, 1924), and *marwicki* Finlay (new name for *brevespira* Marwick, *Trans. N.Z. Inst.*, vol. 55, p. 201, 1924, preoccupied; see elsewhere this volume).

Marwick has rejected the record of an Australian Tertiary species *M. propinqua* Tate from the New Zealand Tertiary (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 324, 1924).

Family **Turridae**. [P. 468]

No comments on this family are offered here, as it is proposed to deal exhaustively with both the Recent and fossil forms in a revision now in preparation, and the many emendations necessary in Suter's arrangement will then be made. Attention may, however, be drawn to the following genera, lately created for New Zealand forms:—

Liracraea Odhner (1924, p. 44), for *Clathurella epentroma* Murdoch.

Rugobela Finlay (1924 c, p. 514), for *Ptychatractus tenuiliratus* Suter.

Parasyrinx Finlay (1924 c, p. 514), for *Pleurotoma alta* Harris.

Austrotoma Finlay (1924 c, p. 515), for *Bathytoma excavata* Suter.

Phenatoma Finlay (1924 c, p. 515), for *Pleurotoma novaezelandiae* Reeve.

Cryptomella Finlay (1924 c, p. 516), for *Leucosyrinx transenna* Suter.

Comitas Finlay (1926, p. 251), for *Surcula oamarutica* Suter.

Insolentia Finlay (1926, p. 252), for *Surcula pareoraensis* Suter.

Zemacies Finlay (1926, p. 252), for *Z. elatior* Finlay.

Speightia Finlay (1926, p. 252), for *Euthriofusus spinosus* Suter.

Fenestrosyrinx Finlay (1926, p. 254), for *Turris nexilis bicarinatus* Suter.

Stilla Finlay (1926, p. 254), for *Mangilia flexicostata* Suter.

Vexithara Finlay (1926, p. 254), for *Antimitra vexilliformis* Marshall and Murdoch.

Marshallena Finlay, 1927 (herein), for *Belophos incertus* Marshall.

Some specific name changes, mostly in connection with Tertiary fossils, have also been introduced by Finlay in two nomenclatural papers, (a) *Proc. Mal. Soc.*, vol. 16, pt. 2, pp. 103, 104, 1924; (b) elsewhere in this volume.

Hedley has recently completed his investigation of the Australian complex grouped under the name "Turridae," and he has suggested that the family is polyphyletic, and the species of heterogeneous origin; one thing is certain, that the austral groups have practically nothing in common with the northern series classed under this family name.

To the Recent fauna have to be added *Heterocithara mediocris* Odhner (1924, p. 43), the first (and a correct) record of this genus from New Zealand; *Guraleus tenebrosus* Powell (*Proc. Mal. Soc.*, vol. 17, p. 37, 1926), which is closely allied to *Drillia lyallensis* Murdoch [P. 482]; and *Mangilia huttoni* E. A. Smith (*Brit. Antarc. "Terra Nova" Exped.*, Zool., vol. 2, No. 4, p. 88, 1915), which Suter has nowhere mentioned.

Genus **Terebra** Lamarck, 1799. [P. 513]

This can be dismissed from the Neozelanic list, since, of the two species, *T. flexicostata* Suter (possibly a synonym of *venosa*, and not Neozelanic) is referable to the genus *Acuminia* Dall (*Nautilus*, vol. 21, p. 124, 1908), while the second may be an aberrant species of *Pervicacia* Iredale (1924, p. 262), or representative of a new group. Suter's subspecies *crassicostata* [P. 515] is not worth recognition; Lyall Bay forms do not differ from those found elsewhere. The Tertiary species are divisible into two groups; the first contains the smaller species, with blunt paucispiral embryo, related to *tristis* Desh., and comprises *costata* Hutton (*Trans. N.Z. Inst.*, vol. 17, p. 315, 1885) (which, as I have noted elsewhere in this volume, is preoccupied, but seems to be inseparable from *tristis*, so may be dropped), *benesulcata* Bartrum (*l.c.*, vol. 51, p. 99, 1919), *omahuensis* Marwick (*l.c.*, vol. 56, p. 326, 1926), and numerous new species; for this assemblage *Pervicacia* may be used. The second group, which may at present be referred to *Acuminia*, consists of larger species with flatter whorls and a sharp polygyrate apex, and contains *orycta* Suter (*Trans. N.Z. Inst.*, vol. 45, p. 296, 1913), *pareoraensis* Suter (*N.Z.G.S. Pal. Bull, No. 5*, p. 62, 1917), *biplex* Hutton (*Trans. N.Z. Inst.*, vol. 17, p. 327, 1885), *sulcata* Marshall (*l.c.*, vol. 51, p. 232, 1919), possibly *bicorona* Hutton (*l.c.*, vol. 17, p. 328, 1885; see also Marwick, *Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 327, 1924), and also many undescribed forms. Marwick, at the reference just quoted, has rejected the Australian Tertiary *T. catenifera* Tate, reported by Suter, as not of Neozelanic occurrence.

Genus **Conus** Linné, 1758.

This has no Recent representative in New Zealand (except for the occasional occurrence of an exotic species in the North Cookian region, e.g., *marmoreus* L. has been recorded alive from Farewell Spit by Miss Mestayer, *N.Z. Journ. Sci. and Tech.*, vol. 1, p. 102, 1918), but the number of Tertiary species is now quite respectable. They are as follows:— *armoricus* and *fusellinus* Suter *(N.Z.G.S. Pal. Bull. No. 5*, p. 61, 1917), *suteri* Cossmann (= *deperditus** Suter), *thorae* Finlay (= *convexus** Marshall), *marshalli* Finlay (= *lyratus** Marshall), *abruptus* Marshall *(Trans. N.Z. Inst.*, vol. 50, p. 270, 1918), *pseudoarmoricus* M. and M. (*l.c.*, vol. 52, p. 135, 1920), *huttoni* Tate (= *ornatus** and *trailli** Hutton), *triangularis* Finlay *(l.c.*, vol. 55, p. 479, 1924), *rivertonensis* Finlay *(l.c.*, vol. 56, p. 255, 1926), and *tahuensis* Allan (*l.c.*, p. 344). The record of *C. catus* Hwass from " a well-digging 10 feet in depth, Chatham Islands " (Harris, *Cat. Tert. Moll. B.M.*, p. 35, 1897) can surely be dismissed. The specimen may have come from " Chatham Island " in Polynesia.

Actaeon craticulatus Murdoch and Suter, 1906. [P. 518]

Hedley, when describing *Acteon roseus (Proc. Linn. Soc. N.S.W.*, vol. 29, pt. 4, p. 536, April 12th, 1906) unwittingly gave a valid name to the New Zealand shell as well. He remarked that " There is a closely allied species from 110 fathoms off the Great Barrier Island, New Zealand, which my friends Messrs. R. Murdoch and H. Suter are about to describe as *A. cratericulatus.* The New Zealand shell differs by being much smaller, with sharper sculpture, the grooves being broader and deeper, and crossed by more distant and elevated threads." This comparison, taken in conjunction with the excellent figure and full description of *A. roseus* Hedley, amounts to a good diagnosis, and as Murdoch and Suter's name was not published till June, 1906, it must be displaced by *Actaeon cratericulatus* Hedley. I select the specimen examined by Hedley, in the Australian Museum collection (fide T. Iredale), as holotype of the species.

No Recent representative has yet been found of our large Pliocene Actaeons, such as *A. praestitus* Finlay (= *sulcatus* Hutton, preoccupied; *Proc. Mal. Soc.*, vol. 16, p. 105, 1924).

Genus **Pupa** Bolten, 1798. [P. 518]

There are several local names available for the local species, and it is unwise to employ one given to an Indo-Pacific shell. Therefore I reject *Pupa affinis* A. Ad. as inapplicable to Neozelanic shells, none of which show the peripheral groove emerging below the suture, or have the same outlines as Adams's shell. For the small *Actaeon*-like form common in northern deep-water dredgings, Hutton's *Buccinulus albus* is suitable; the type is lost, but there is only one small New Zealand species, and sufficient data is given in Hutton's diagnosis and measurements to indicate that he described this; as the shell occurs all round the Hauraki Gulf and its precincts, and it is advisable to have a type specimen, I chose as neotype a specimen in the

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*See nomenclatural notes elsewhere in this volume.

Finlay collection, dredged in Hauraki Gulf in 25 fathoms. Suter's figure is too slender and has the base too regularly contracted.

Examination of type material in the Dominion Museum convinces me that *Buccinulus kirki* Hutton, 1873 is identical with and has priority over *B. gracilis* Kirk, 1882, but that *B. huttoni* Kirk, 1882 is possibly different. Too few specimens are available for a full investigation, but in the meantime I recommend that two large species be recognised under these names, and suggest that there may really be only one.

Genus **Triploca** Tate, 1894.

This has been added to the Tertiary fauna by Marshall and Murdoch (*Trans. N.Z. Inst.*, vol. 54, p. 128, 1923) with a new species *T. waihaoensis*, which is closely allied to the only other species of the genus, the Australian Tertiary *T. ligata* Tate.

Leucotina pura (A. Adams, 1855). [P. 521]

From study of the type in the British Museum, Hedley recognised that A. Adams' species was a Sydney shell, and the ascription to New Zealand consequently erroneous; the record should be eliminated.

Bullina scabra (Gmelin, 1791). [P. 522]

This name has already been changed by Iredale in his "Commentary," but unfortunately still another change is necessary, as *Voluta ziczac* Muhlfeldt, 1878, had been anticipated by Schroeter, 1804, so that the name to be used now appears to be *Bullinula lineata* Gray, 1825 (information from T. Iredale). Authentic New Zealand specimens have been collected in late years by Powell at Mt. Maunganui and Great Barrier Island (see also Bucknill, 1924, p. 78).

Genus **Ringicula** Deshayes, 1838. [P. 523]

To *R. uniplicata* Hutton, the sole Tertiary species recorded by Suter, must now be added *R. torquata* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 326, 1926); there are, however, many undescribed new species.

Hydatina physis (Linné, 1758).

Powell has lately added this to the New Zealand fauna by recording the finding of a live specimen on Great Barrier Island (*N.Z. Journ. Sci. & Tech.*, vol. 6, Nos. 5 & 6, p. 284 with text fig., 1924).

Genus **Volvulella** Newton, 1891. [P. 529]

Hedley (*Proc. Linn. Soc. N.S.W.*, vol. 41, p. 716, 1916) has indicated that this must be replaced by ***Rhizorus*** Montfort, 1810, proposed for *R. adelaidis* Mont.=*Bulla acuminata* Brug.

The New Zealand species is at present unnamed. Suter identified Recent shells with the "Miocene" *Cylichna reflexa* Hutton, from White Rock River, though commenting (*N.Z. Geol. Surv. Pal. Bull. No.* 3, p. 46, 1915) that Recent specimens were somewhat larger than the type. This is constantly the case, but there are far more marked distinctions also. The fossil shell has a long and very sharp spire, notably concave at its base, which gives it the appearance of a projecting thorn, while the Recent shell has only a short and not

very sharp apex of fairly regular formation. The little chink-like perforation on the inner side of the spire is consequently much more drawn out in true *reflexus*, which also justifies its name in having the basal lip more reflexed, with a stouter, more oblique pillar-plait. Both shells have fine dense spirals all over, but the stronger grooves on base and apex are more numerous and closer in the fossil. In relation to width, the Recent shell is considerably more elongate, especially as regards the inner half of the body whorl as seen from the front. Suter has figured a Recent shell (though the pillar twist is too strong and the shell rather short), so I give the name *Rhizorus nesentus* nov. to the specimens dredged in 38 fathoms off Cuvier Island, selecting a type from that locality in the Finlay collection.

Genus **Cylichnella** Gabb, 1873. [P. 530]

Suter includes two Australian species, *pygmaea* A. Ad. and *thetidis* Hedley, stating that *arachis* Q. & G. does not occur in New Zealand waters, and that the type of Kirk's *C. zealandica* is lost. This is a mistake, for it and three syntypes are in the Dominion Museum, Wellington; Hedley, who examined them, left a note that the type was *C. arachis* and the syntypes *C. thetidis*. On the strength of this, Miss Mestayer (*N.Z. Journ. Sci. & Tech.*, vol. 3, Nos. 5 & 6, p. 303, 1921) has identified some 50 examples sorted from Hauraki Gulf dredgings as *C. arachis* (Q. & G.). Two, at least, of these records of Australian shells must now be rejected. When Hedley returned Kirk's type material, he sent also Sydney specimens of *arachis* for comparison, but Miss Mestayer evidently did not use them, for differences are obvious, and could hardly have been overlooked. The Australian shells grow to more than twice the size of the New Zealand species, the top of the aperture rises much higher, the apex of the shell narrows in considerably so that the pit round the perforation is much narrower (the perforations are about the same size relative to width of shell, but the width of the pit border is much narrower in *arachis*), and the pillar plait in New Zealand shells is very much weaker, lower down, and with no groove behind it. *C. zealandica* Kirk must be revived for this form. As regards *C. thetidis* Hedley, Suter's figure in the "Atlas" seems to be a copy of Hedley's original fine drawing (*Mem. Austr. Mus.*, vol. 4, pt. 6, p. 395, fig. in text, 1903), but the little material available does not enable me at present to separate Australian and New Zealand specimens.

Cylichnella pygmaea A. Ad. does not occur in New Zealand, and it is hard to say what Suter's figure is intended to represent, for it is not like the New Zealand shell, yet does not well portray true *pygmaea;* it is probably a poor copy of some other figure. The New Zealand form is stouter and much wider on top than Adams's shell, and the perforation much larger; I describe it as a new species below. Hedley and May have placed these forms in *Cylichnina* Monterosato, and here may (at present) also be referred the remaining New Zealand species, *Cylichna striata* Hutton, which is a close ally of *C. iredaleana* Hedley.

Cylichnina opima n. sp. (Fig. 34).

Shell small, squat, but well inflated for its size, pure white. Sculpture of numerous close incised grooves over whole surface. Shell widest near base, but very little narrowed posteriorly. Apex hollowed out, the pit occupying only about one half area of top, with a blunt edge, perforation at its bottom narrow, open, about half width of bordering rim. Aperture longer than shell, a little projecting above, effuse below. Pillar straight, slightly bent to left, with no plait, but a distinct rounded truncation at its base.

Height, 3.3 mm.; diameter, 1.8 mm.

Locality,—Lyall Bay, in shell sand.

Bullaria adamsi (Menke, 1850). [P. 534]

This should be dismissed from the Neozelanic fauna. A shell which has borne the above name may occur in the extreme north, but it is improbably Menke's species, and further authentic specimens must be collected and examined before any conclusions can be drawn.

Bullaria australis (Q. and G.). [P. 535]

Gray's name was incorrectly rejected because, according to Suter, his " descriptions are quite inadequate and not accompanied by a figure." However, when Hedley referred New South Wales shells to Iredale for comparison with the types in the British Museum, although they agreed, Gray's name was found to be preoccupied; none of the recorded synonyms had reference to the Australian species, so Hedley proposed for it the new name *Bullaria botanica* (1918A, p. M 104, No. 1104). This name does not enter the Neozelanic fauna, since Gray's *Bulla quoyi* is sufficiently distinct to be separated; consequently the whole of the Neozelanic shells will bear the name *Bullaria quoyi* Gray, 1843, no variety being recognized, and *Bullaria australis* Q. & G. will be removed from the Neozelanic list.

Family **Peltidae.**

Odhner (1924, p. 46), in establishing a new genus *Runcinella*, with *R. zelandica* nov. (from Cape Brett, near Bay of Islands) as type, has added this to the Neozelanic fauna, as " Family *Runcinidae*"; the generic name *Pelta* Quatrefages, however, antedates *Runcina* Forbes, and is usually made the basis of the Family name.

Umbraculum umbellum (Martyn, 1786). [P. 549]

Iredale (*Proc. Mal. Soc.*, vol. 12, pts. 2 and 3, p. 89, 1916) noted that Solander's name *Patella umbraculum (Cat. Port. Mus.*, p. 178, April, 1786) had priority over Martyn's name, which occurred in the third volume (not second as printed in Iredale's paper), and this volume was not published until 1788. However, Hedley has named the Sydney form *Umbraculum botanicum (Proc. Linn. Soc. N.S.W.*, vol. 48, pt. 3, p. 315, 1923), and included under this name the form occurring at Lord Howe Island, Norfolk Island, and the Kermadec Islands. At the last named locality Iredale tells me that he collected a few specimens and noted that the shells and animals differed, and was unable to find any record of the explanation of these differences. The most feasible one was that they were sexual. Similar specimens

were shown Iredale by the late Mr. G. Gross at Brisbane, who had been similarly puzzled. Roy Bell sent the two forms of shell from Norfolk and Lord Howe Islands, and Iredale searched for them in the Sydney district. Collecting at Long Reef, near Manly, New South Wales, in September, 1924, Iredale and I found two specimens associated which showed these differences exactly and proved them to be sexual. The larger specimen was bluish, with massed nodules, the sole being pale bluish-white; the shell was large, flattened, the central portion clear of extraneous growth. The smaller one was distinctly yellowish, with dark bluish-green, rather more separated nodules, the sole being deep yellow; the shell was smaller, more conical, and entirely covered with growth.

Suter's record stood in need of confirmation, and this has lately been supplied by Powell (*N.Z. Journ Sci. & Tech.*, vol. 6, nos. 5 and 6, p. 286, 1924) who has recorded the trawling of two live specimens of *botanicum* in 20-30 fathoms near the Hen and Chicken Islands.

Pleurobranchaea novaezelandiae Cheeseman, 1878. [P. 553]

The carnivorous habits and spawning of this creature have been noted by Miss Mestayer (*N.Z. Journ. Sci. & Tech.*, vol. 3, p. 170, 1920).

Suborder **NUDIBRANCHIA.** [P. 554]

This group will provide much novelty to the first student who takes an interest in it. Iredale collected many more species than Suter has included, though few of the recorded forms. These, he informs me, were sent to Sir Charles Eliot, but have never been reported on, and never will be now by Eliot, or probably anyone else in the near future.

The last molluscan work that engaged Iredale's attention in England was the establishment of Nudibranchiate nomenclature on a firm basis (vide Iredale and O'Donoghue, *Proc. Mal. Soc.*, vol. 15, pp. 195-233, 1923). From this point of view alone the following emendations are necessary; the page references being to the paper quoted:—

Tribe TRITONIOMORPHA must become Superfamily ZONABRANCHIATAE (p. 229).

Family Tritoniidae must become Family Duvauceliidae (p. 229).

Genus *Tritonia* must become Genus *Sphaerostoma* Macgillivray, 1843 (p. 229).

Tritonia incerta must become *Sphaerostoma incerta* (Bergh, 1904).

Tribe DORIDOMORPHA must become Superfamily PHANEROBRANCHIATAE (p. 217).

Family Goniodorididae must become Family Okeniidae (p. 217).

Genus *Acanthodoris* must be referred to Family *Onchidoridae* (p. 219).

Family Dorididae must become Family Doridigitatidae (p. 226).

Genus *Doris* must become Genus *Archidoris* Bergh, 1878 (p. 228).

Subgenus *Homoiodoris* must become Genus *Homoiodoris* Bergh, 1882.

Subgenus *Ctenodoris* must become Genus *Ctenodoris* Eliot, 1907.

Aphelodoris cheesemani must become *Aphelodoris luctuosa* (Cheeseman, 1882).

Tribe EOLIDOMORPHA must become Tribe CLADOHEPATICA (p. 200).
Genus *Eolis* must become Genus *Æolidia* Cuvier, 1798 (p. 200).
Eolis leptosoma must become *Æolidia leptosoma* (Hutton, 1884).
Genus *Aeolidiella* must become Genus *Eolidina* Quatrefages, 1843 (p. 201).
Aeolidiella drusilla must become *Eolidina drusilla* (Bergh, 1900).
Aeolidiella faustina must become *Eolidina faustina* (Bergh, 1900).
Genus *Eolidia* must become Genus *Dolicheolis* nov., proposed for:—
Eolidia longicauda must become *Dolicheolis longicauda* (Q. and G., 1832).
Family PROCTONOTIDAE must become Family ZEPHYRINIDAE (p. 213).
Genus *Antiopella* must become Genus *Janolus* Bergh, 1884 (p. 213).
Antiopella novozealandica must become *Janolus novozealandicus* (Eliot, 1907).
Genus *Fiona* Hancock and Embleton, 1853, must become Genus *Fiona* Forbes and Hanley, 1851 (p. 212).
Fiona marina must become *Fiona pinnata* (Eschscholtz, 1831) (p. 212).
Tribe ELYSIOMORPHA must become Suborder ASCOGLOSSA (p. 197).
Family HERMAEIDAE must become Family STILIGERIDAE (p. 199).

But few incidental notes on the species have appeared since the publication of the "Manual." Young has recorded and described the spawning of *Archidoris wellingtonensis* (Abraham) (*N.Z. Journ. Sci. & Tech.*, vol. 7, No. 3, p. 189, 1924). Powell (*N.Z. Journ. Sci. & Tech.*, vol. 6, Nos. 5 & 6, p. 286, 1924) has recorded the finding of *Sphaerostoma incerta* (Bergh) in abundance at several localities in the North Island, while Odhner (1924, pp. 52-54) has identified seven New Zealand species in the material collected by Dr. Th. Mortensen, giving notes on the dentition of *Alloiodoris lanuginata* (Abraham) and *Chromodoris amoena* Cheeseman, and adding a genus to the Suborder as developed in New Zealand by describing *Cuthona zelandica* nov. He remarks that this is a true *Cuthona,* but compares it with *Eolis stipata* Alder and Hancock which is a *Cratena.*

Ophicardelus australis (Q. and G., 1832). [P. 590]

This name is used by Suter for the Neozelanic shell, but it was given to a shell collected at Western Port, Victoria and Hobart, Tasmania. For this Australian species Hedley has used *ornata* Ferussac, placing it in the European genus *Phytia.* One may unhesitatingly reject the latter genus name in favour of *Ophicardelus,* given to the austral forms. From Lakes Entrance, Gippsland, Iredale has received a large number of specimens collected by Roy Bell, and these showed three species, "*australis,*" "*stutchburyi,*" and "*quoyi.*" The former proved to be the *ornata* shell, the second agreed with *sulcata,* which Hedley included in the New South Wales List, and with the types of *stutchburyi,* described from Port Curtis, Queensland, and the third with the types of *quoyi,* described from Moreton Bay, which Hedley did not include in the N.S.W. List, but suggested might be Neozelanic.

Mr. A. E. Brookes sent New Zealand specimens to Iredale, and these he tells me are very close to the Australian *quoyi*, and must be called *costellaris* (H. & A. Adams, 1855) (*Proc. Zool. Soc.* for 1854, p. 12; described as *Melampus*).

Cremnobates parva Swainson, 1855. [P. 594]

The figure of this shell is a rather poor copy of one prepared by Hedley, and published by Hedley and Suter (*Proc. Mal. Soc.*, vol. 9, pt. 3, p. 152, in text, 1910); it was drawn from a South Tasmanian topotype, and Suter remarks that: "All the shells from the Antipodes have the spire considerably shorter than the aperture, but this would hardly appear to be sufficient reason for establishing a variety or subspecies. The type, figured by Swainson, has the height of the spire equal to that of the aperture: the total height is 7 mm." Further study of this group shows the differences to be of much greater value and fully specific. Odhner (1924, p. 86, "Addenda"), in proposing to call Auckland Island specimens (which he figures) "var. *striata* n.," notes a further difference in that the Subantarctic shells are spirally lirate, at least on the upper whorls. I therefore adopt Odhner's name as of full specific rank, so that *Marinula striata* Odhner will replace *Cremnobates parva* Swainson in New Zealand lists; the genus seems restricted in this Region to the Rossian province.

Siphonaria australis Q. and G., 1833. [P. 598]

Oliver has made some remarks in his Ecological Essay on the relationships of this species and *S. zelandica* of the same authors. The former was described from Cook Strait as a small elongately oval shell, with 50 ribs, measuring 14.5 by 10.5 mm., and living on *Durvillea utilis*. The latter was only localized as from New Zealand, and said to be a large roundish shell measuring 19 by 16.8 mm., with twenty ribs.

If one judges from study of the Australian forms, these may be very distinct species, the station being a characteristic feature of the species in this genus, though the extent of the station may at first obscure the distinction. The chief difference recorded for the Neozelanic shells is the form of the lateral teeth of the radula; if this be confirmed they must be regarded as distinct species. Re-examination of the dentition of New Zealand Siphonarias is urgently needed and may lead to the discovery of several new species.

Hedley has reported *Kerguelenia redimiculum* (Reeve) and (doubtfully) *K. lateralis* (Gould) from Macquarie Island (1916, p. 61). The Antipodes Island *K. innominata* Iredale (1915, p. 478) closely agrees, but *S. obliquata* Sowerby must receive a new generic name. Conchologically it is quite aberrant; Iredale, noting this, suggested its inclusion in *Kerguelenia* (1915, p. 478), but the *redimiculum* group is quite a large one and will not easily contain *obliquata*, which seems to be a more northerly development from that stock. I therefore propose it as type of *Benhamina* nov., naming this genus in tribute to one of New Zealand's best-known zoologists, William Blaxland Benham. Miss Mestayer (*N.Z. Journ. Sci. & Tech.*, vol. 3, p. 171, 1920) has recorded the spawning of this form and given a good figure (in text) of a clean specimen.

Gadinia nivea Hutton, 1878. [P. 603]

Discussing the discovery of a "*Gadinia*" at the Kermadecs, Iredale concluded (*Proc. Mal. Soc.*, vol. 9, p. 71, 1910) that only one species occurred at the Kermadecs, New Zealand, and Australia. As usual, lumping necessitates revision, and radular characters now show that the New Zealand *nivea* is abundantly distinct. Hutton has published an account of his *Gadinia nivea* and gave the formula of the radula, which he figured (*Trans. N.Z. Inst.*, vol. 15, p. 144, pl. 17, figs. S-V, 1883) as $60 — 1 — 60 \times 150$, the central tooth multi-cuspid, the inner laterals twenty-one, the outer thirty-nine, all with toothed cusps. Claude Torr has figured (*Trans. Roy. Soc. S. Austr.*, vol. 38, p. 367, pl. 20, fig. 6, 1914) the radula of the South Australian form as $30 — 1 — 30 \times 100$, the central tooth with one large cusp, the inner laterals obscurely bicuspid, the outers unicuspid. The New South Wales form is being re-investigated when fresh material is procured, for Iredale found that the specimens in the British Museum showed a formula of about $40 — 1 — 40 \times 120+$. These figures are sufficient to show that different species are being confused, and that the specific name *nivea* Hutton should be reinstated for the Neozelanic form.

Genus **Amphipeplea** Nilsson, 1822. [P. 607]

Kennard and Woodward have recently noted (*Proc. Mal. Soc.*, vol. 16, pt. 3, p. 125, 1924) that the date of publication ascribed to Nilsson's *Historia Molluscorum* is incorrect and should be 1823, and that therefore *Myxas* (Leach) J. Sowerby, June, 1822 (monotype: *Helix glutinosa* Mont.) has priority over *Amphipeplea* Nilsson, and claims usage. This name must not be confounded with *Myxa* Hedley (*Mem. Austr. Mus.*, No. 4, p. 362, 1903), proposed for a Pyramidellid mollusc; the names are sufficiently distinct not to clash.

Genus **Ptychodon** Ancey, 1888. [P. 689]

The sole addition to the land molluscan fauna since Suter's death is *Ptychodon suteri* Murdoch and Finlay described from a subfossil deposit in the South Island (*Trans. N.Z. Inst.*, vol. 54, p. 133, 1923). It is to be hoped that some worker will soon come forward to fill the gap left in this branch by the loss of Suter and Murdoch; there is much work—descriptive, classificatory, ecological, and distributional—to be done.

Genus **Dentalium** Linné, 1758. [P. 817]

Two fossil and one Recent species have lately been added to the New Zealand list. The Recent form is *D. marwicki* Mestayer (*Trans. N.Z. Inst.*, vol. 56, p. 587, 1926), a form previously confused with *nanum* Hutton. The fossils are the Tertiary *D. otamaringaensis* Marwick (*l.c.*, p. 326), and the Upper Cretaceous *D. (Laevidentalium) morganianum* Wilckens (*N.Z.G.S. Pal. Bull.* No. 9, p. 24, 1922), which its author states is unexpectedly plentiful for a Cretaceous *Dentalium;* later (*Trans. N.Z. Inst.*, vol. 55, p. 543, 1924) he regards the occurrence of a fragment so identified as sufficient evidence of the Upper Senonian age of the Green Island greensands! Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 319, 1924) has noted that the occurrence of the New Zealand Tertiary *D. mantelli* Zitt. in

Australian Tertiary beds is by no means beyond doubt, and that the Australian workers have confused several species. For a nomenclatural note on the Jurassic *D. huttoni* Bather (non Kirk) *(Geol. Mag.*, dec. 5, vol. 2, p. 532, 1905) see elsewhere in this volume.

Cadulus teliger n. sp. (Figs. 52, 54).

Shell small, vitreous, lightly curved, smooth except for numerous growth-rings. First half of shell fairly quickly increasing in diameter, second half of practically uniform width till near anterior end, where there is a slight constriction near mouth, much better marked on inner side. Curve of shell almost uniform on outer side, but distinctly irregular on inner, curve of first third being regular, thence diminishing till for last half inner side is practically straight, giving an asymmetrically swollen appearance to shell. Aperture with a thin, sharp edge, outline almost circular, but a little compressed on outer side. Posterior opening of somewhat same outline, but edges not so thin, furnished on convex side of shell with a medial sharp projecting tela, in the shape of an isosceles triangle with the equal sides slightly convex and the apex narrowly rounded off.

Length, 4.7 mm.; diameter, 0.7 mm.

Locality,—Off Auckland Island in 95 fathoms.

This is the form Suter has admitted as *C. spretus* Tate & May—from which it differs in almost every particular.

Nucula strangei A. Adams, 1856. [P. 833]

We must revert to this name for the New Zealand shell, for, though Iredale recorded Hedley's determination as against it (1915, p. 483), study of the types shows that no change is necessary, the other supposed synonyms being referable to the Australian species, which can be easily separated from the Neozelanic form.

Hedley has added his genus *Pronucula* by describing a new Macquarie Island species, *P. mesembrina* (1916, p. 17), and as Oliver has recorded the genus from the Kermadecs, also by a new species, *P. kermadecensis* (1915, p. 550), it is fairly certain that it occurs throughout the mainland. I know, at all events, of at least one new species occurring in 60 fathoms off Otago Heads.

Add *Nucula grangei* and *ruatakiensis* Marwick (*Trans. N.Z. Inst.*, vol., 56, p. 327, 1926) to the Tertiary fauna.

Family **Nuculanidae**. [P. 834]

For a peculiarly rostrate little form with curious radial sculpture, Marwick has introduced a new genus *Zealeda*, monotype: *Z. hamata* Marwick *(Proc. Mal. Soc.*, vol. 16, pt. 1, p. 25, 1924), from the Pliocene Awatere Beds. He has since *(Trans. N.Z. Inst.*, vol. 56, p. 328, 1926) described a second species as *Z. mutabilis*, noting that Dall considers *Zealeda* a synonym of his *Spinula*, but rightly pointing out the numerous differences that deny it close relationship. Several new congeneric species (including a Recent form) are known to me.

Two more fossil species of *Nuculana (ellisi* and *onairoensis)* have been described by Marwick *(Trans. N.Z. Inst.*, vol. 56, p. 328, 1926), while Allan *(l.c.*, p. 344) has noted that I would here place *Sarepta solenelloides* Marshall, 1919 *(Trans. N.Z. Inst.*, vol. 51, p. 233) and

has described *N. belluloides* nov. from the McCulloughs Bridge greensands. From comparison of type material in my collection, I can affirm that this is a synonym of *Leda semiteres* Hutton, 1877 (*Trans. N.Z. Inst.*, vol. 9, p. 598), the types of both are ancestral *bellula* forms, and from the same locality.

Woods (1917, p. 17) has described an Upper Cretaceous species as *N. amuriensis* and notes the occurrence of a second species, figured but left unnamed.

Solenelloides seems referable to the subgenus *Pseudoportlandia*, recently created by Woodring (1925, p. 20) for *Leda clara* Guppy, a Miocene species from Jamaica; it closely resembles the genotype, and, if really belonging here, is only the third known species of this distinct group. The section *Jupiteria* Bellardi is known to me by undescribed Tertiary species in New Zealand, while *onairoensis* Marwick and *amuriensis* Woods should probably be referred here. The remaining species, *fastidiosa* A. Ad., *bellula* A. Ad., *ellisi* Marwick, and *semiteres* Hutton, may be placed in *Saccella* Woodring (*l.c.*, p. 15), proposed to replace *Ledina* Sacco, not of Dall, the genotype being the Mediterranean *Arca fragilis* Chemnitz.

Genus **Malletia** Desmoulins, 1832. [P. 836]

Marwick has noted (*Trans. N.Z. Inst.*, vol. 56, p. 329, 1926) that *Neilo* A.Ad., 1854, which Suter treats as a subgenus [P. 837] is so distinct from *Malletia* that it should be regarded as a full genus, and under this name four species have been added last year to the Tertiary fauna, *sinangula* and *awamoana* Finlay (*Trans. N.Z. Inst.*, vol. 56, pp. 255, 256, 1926) and *sublaevis* and *waitaraensis* Marwick (*l.c.* p. 329). Marwick, however, retains *Malletia*, in the form of the subgenus *Minormalletia* Dall, for a fifth species, *tenera* Marwick (*l.c.*, p. 328), but the specimens are not well enough preserved to allow of satisfactory generic location. Dall (*Bull. Mus. Comp. Zool*, vol. 43, No. 6, p. 385, 1908) introduced *Minormalletia* (type M. *arciformis* Dall) with two species, defining it as "Shell small, blunt, plump, with amphidectic ligament, no resilium, the pallial sinus large, no radial depressions or sculpture." Marwick's shell is very flat, and the character of the pallial sinus, noted by Dall as not of the usual Malletinid type, was not determined, so that a new location (probably a new genus) will be required when better specimens are available.

To the species mentioned above must also be added the Palaeocene *M. elongata* Marshall (*Trans. N.Z. Inst.*, vol. 49, p. 458, 1917) (see nomenclatural note elsewhere this volume) and the upper Cretaceous M. (*Neilo*) *cymbula* Woods (1917, p. 18); both these are referable to *Neilo*, which thus has an extended lineage.

Poroleda lanceolata (Hutton, 1885). [P. 839]

The Recent Neozelanic form has been named *Poroleda pertubata* by Iredale, the correct reference to the generic name being given at the same time (1924, p. 185). I figure a Dusky Sound specimen (fig. 69) in my collection; *pertubata* differs from the mid-Pliocene *lanceolata* chiefly in greater elongation, the length being more instead of less than three times the height.

Genus Sarepta A. Adams, 1860.

This name has been used by Australian writers to cover the Tertiary *Leda obolella* Tate (*Trans. Roy. Soc. S.A.*, vol. 8, p. 129, 1886) and its Recent descendant *Sarepta (?) tellinaeformis* Hedley (*Rec. Austr. Mus.*, vol. 4, p. 26, 1901). The fossil species has been reported from New Zealand by Suter (*Alph. List N.Z. Tert. Moll.* p. 24, 1918), while Marshall has described three further Tertiary species. Of these, his *S. solenelloides* has just been dealt with under *Nuculana*, and his *S. tenuis* (*Trans N.Z. Inst.*, vol. 51, p. 233, 1919) seems to be identical with the species he describes immediately after it, *Limopsis hampdenensis*, a much better generic location; but his *S. aucklandica* (*l.c.*, vol. 50, p. 271, 1918) seems to be congeneric with Hedley's *tellinaeformis*, for which Iredale has now provided the genus *Ovaleda* (*Rec. Austr. Mus.*, vol. 14, no. 4, p. 250, 1925).

Anomia furcata Suter, 1907. [P. 842]

This species is under an extraordinary cloud. Oliver states that it is a *Monia*, that there are only two muscle-scars in the left valve, though Suter repeatedly referred to and figured three, and that Suter's statement that these muscle-scars could be seen in only one specimen is incorrect (*Proc. Mal. Soc.*, vol. 15, pt. 4, p. 180, 1923).

Suter states: "Colour whitish-yellow. Interior of same colour, and somewhat pearly, with a sharp and smooth margin." This is not characteristic of *Monia*, which is greenish-white outside and darker green internally. The muscle-scars of *Monia* are two, one nearly circular and striated, the other circular, smaller, and nearly touching or confluent; never is the (generally well-marked) muscle-scar "long, tongue-shaped."

Examination of the type and numerous specimens dredged off Otago Heads and elsewhere indicates that Oliver was correct in his description of the type shell, and that Suter's drawings are erroneous; the specimen in which Suter saw three muscle-scars may have been a young *Anomia*, or the effect may have been imaginary. As a species, I find *furcata* difficult to separate satisfactorily from *zelandica*, especially where juvenile shells are concerned; the muscle-scars in both are quite variable, the upper larger, suboval (sometimes in compressed shells rather elongate, but never to the extent Suter has figured), radially striate, and confluent with or separated from the lower. The interior is always dark-greenish centrally in fresh shells, and Suter's description of the colour of *furcata* is probably due to his handling water-worn shells. I can only note that *zelandica* seems to grow to a larger size than *furcata* (of which I have specimens over 40 mm. in length, i.e. nearly three times the size of Suter's), and has coarser radial sculpture and a larger byssal opening in the right valve. *Zelandica* has been accepted as the type of *Monia* by Winckworth (*Proc. Mal. Soc.*, vol. 15, pt. 1, p. 33, 1922).

Anomia undata Hutton, 1885* [P. 843]

This species has caused more trouble even than the last. The latest pronouncement on it is by Marwick (*Trans. N.Z. Inst.*, vol. 55,

*See nomenclatural note elsewhere in this volume.

p. 191, 1924) who has figured the type and an adult Pliocene example, comparing it with *trigonopsis.* I have grave doubts whether *walteri* can be retained as distinct from the latter species, the characters noted by Oliver (*Proc. Mal. Soc.,* vol. 15, pt. 4, p. 180, 1923) being inconstant, while the same variation is noticeable in "Miocene" specimens. But *undata* is quite distinct; Marwick notes the different formation of the muscle-scars, the lower being relatively huge. No localized Recent records have been made; I therefore mention that I have several specimens from Auckland Harbour.

Family **Arcidae.** [P. 846]

Oliver (*Proc. Mal. Soc.,* vol. 15, p. 182, 1923) has added the Australian *Arca trapezia* Desh. to the Neozelanic fauna from two water-worn valves from Spirits Bay, and a well-preserved valve from Muruwai; he states that "all these specimens are large, heavy shells, but I am unable to separate them as a species from Australian specimens of *A. trapezia.*" This is an interesting record, but seems to call for further investigation before this Peronian species can be definitely accepted as a natural constituent of the New Zealand fauna. Marwick has stated (*Gedenboek Verbeek,* p. 370, 1925) "*Anadarca* and *Scapharca*....In New Zealand these two subgenera are absent;" it may be noted that Woodring (*Carnegie Inst. Wash.,* Publication No. 366, p. 40, 1925) has supplied the new name *Diluvarca* (type: *Arca diluvii* Lk.) for "*Anadarca* of authors, not of Gray, 1847," with which he unites "*Scapharca* of authors, not of Gray, 1847," and this is the group-name to be used for *Arca trapezia* above. Another group has been introduced into the Tertiary lists by the description of *Fossularca januaria* Marwick (*Trans. N.Z. Inst.,* vol. 56, p. 310, 1926). Woods (1917) has described "*Arca*" *hectori* and *Arca (Barbatia)* sp. from Upper Cretaceous beds, while his "*Nemodon* sp." (*l.c.,* p. 19) has been referred by Wilckens (1920) to the Antarctic and South Indian Cretaceous genus *Nordenskjöldia* Wilck. (*Schwed. Südpol. Exped.,* Bd. 3, lief. 12, p. 26, 1910; type: *N. nordenskjöldi* Wilckens), and named *N. woodsi* Wilckens.

Brookes (*Trans. N.Z. Inst.,* vol. 56, p. 590, 1926) has added another Recent species by describing *Arca sociella* from the Bay of Islands. Contrary to his statement, the ligament is confined to a very oblique patch behind the beaks; and this, together with the characteristic reticulate sculpture, renders the species referable to *Acar* Gray (type: *Arca gradata* Brod. & Sow.; designated by Woodring, *Carnegie Inst. Wash., Pub.* No. 366, p. 37, 1925). *Acar* is known to me from the Tertiary also, by new species from the mainland and Chatham Islands.

True *Arca* is represented in New Zealand only by the Tertiary *A. subvelata* Suter (*N.Z.G.S. Pal. Bull. No.* 5, p. 65, 1917) and an allied form which will be described by Marwick from the Chatham Islands.

Genus **Bathyarca** Kobelt, 1891. [P. 850]

Iredale (1924, p. 186) has written that *Bathyarca* "appears to be the southern degenerate deepwater relation of the tropical *Cucullaea,*

agreeing in most essential features." The sole New Zealand species is very common in Recent dredgings but is not known fossil.

As regards the Tertiary species of *Cucullaea,* it may be noted that *C. worthingtoni* Hutton *(Cat. Tert. Moll.,* p. 27, 1873) is identical with and has priority over *C. attenuata* Hutton *(l.c.,* p. 28), a more common name in Tertiary lists. Woods has added a Cretaceous species, *C. zealandica* (1917, p. 20), and Allan *(Trans. N.Z. Inst.,* vol. 56, p. 345, 1926) has described an early Tertiary species as *C. waihaoensis.*

Genus **Glycimeris** Da Costa, 1778. [P. 850]

Marwick has written a revision entitled "The Genus *Glycimeris* in the Tertiary of New Zealand," describing many new species. Elsewhere he has rejected *striatularis* Lk. as not Neozelanic *(Rep. Austr. Assoc. Adv. Sci.,* vol. 16, p. 329, 1924). To Marwick's list of species has to be added the Palaeocene *G. concava* Marshall (*Trans. N.Z. Inst.,* vol. 49, p. 459, 1917) and the Upper Cretaceous *G. selwynensis* Woods, (1917, p. 20).

Genus **Limopsis** Sasso, 1827. [P. 853]

Add to the Tertiary species *L. hampdenensis* Marshall *(Trans. N.Z. Inst.,* vol. 51, p. 233, 1919) (which should probably be *L. tenuis;* see note on *Sarepta, antea*), *campa,* and *waihaoensis* Allan (*l.c.,* vol. 56, pp. 345, 346, 1926). *L. producta* Finlay and McDowall *(l.c.,* vol. 54, p. 112, 1923) I now regard as a distorted specimen of *zealandica* Hutton. Marwick has advocated the use of Hutton's name *(Rep. Austr. Assoc. Adv. Sci.,* vol. 16, p. 329, 1924) instead of *aurita* (Brocchi), and of *zitteli* Iher. instead of *insolita* (Sow.), these extra-limital species names being rejected.

Family **Philobryidae.** [P. 856]

I have to thank Mr. Tom. Iredale for the following notes:— "Bernard's results and conclusions were never reviewed by that brilliant worker, his early death proving a calamity to malacological science, especially as regards Pelecypods. In every case, fuller knowledge has caused emendations, and in the case of these small bivalves there can be little doubt, judging from his published works, that Bernard would have seriously revised his first accounts.

Thus, *Hochstetteria* was first published by Velain in the *Comptes Rendus Acad. Sci. (Paris),* vol. 83, p. 285, July 1876,in connection with three species, *H. crenella, aviculoides,* and *modiolina,* all from the Ile Saint Paul, and all *nomina nuda,* so that the name has no validity at this date. In the *Archiv. Zool. Experiment Generale,* vol. 6, "1877" (probably not published until 1878) the genus *Hochstetteria* was fully diagnosed, animal as well as shell characters being noted (p. 129) with the same three species, all figured: *H. aviculoides* p. 130, pl. 5, figs. 3, 4; "Very abundant on the littoral": *H. modiolina* p. 131, pl. 5, figs. 7, 8; "Dredged 35 M.": *H. crenella* p. 131, pl. 5, figs. 5, 6; "Dredged 35 M."; the observation being made that "*H. aviculoides* est la seule des trois espèces qui avait été recueillie avec l'animal." Consequently this species must be regarded as the type of the genus, and in his first essay Bernard used *Hochstetteria* in this sense,

describing *H. costata* and *H. meleagrina* from New Zealand. The latter seems to be very nearly allied to *H. aviculoides* in every detail, even to the station. Bernard afterward regarded the genus *Philobrya* of Carpenter as equivalent to this, so transferred the genus name *Hochstetteria* to species like *H. crenella* and thereafter described *H. trapezina* from New Zealand. This action, quite incorrect in every way, has been accepted and the name *Hochstetteria* used thus by Suter.

Hedley took up the study of these interesting bivalves, and noting the differences between the smooth capped and uncapped "Philobryas," used *Philippiella* for the latter. Recently, in his Antarctic Mawson Report (1916, p. 20), he dealt with the Subantarctic forms again, and restricted *Philippiella* to Antarctic forms, proposing *Notomytilus* for the Australian species previously so called." *(in litt.)* In the genus *Philippiella* he included *P. meleagrina*, adding a new species from Macquarie Island, *P. hamiltoni*. To this species the Rossian *P. modiolus* Suter (the figure of which in the "Atlas" is quite inadequate: I present new figures, taken from topotypes; figs. 86-89) is very closely allied. The essential point so far, then, is that *Hochstetteria* Velain = *Philippiella* Pfeffer, and Hedley, 1916, not Hedley, 1904, and is not *Hochstetteria* Bernard, 1897, and Suter.

The costate group, such as *costata* Bernard (which has been compared with the Australian *paralellogramma* Hedley; *Proc. Linn. Soc. N.S.W.*, vol. 30, p. 545, 1906), is a very distinct one in sculpture, form, prodissoconch formation, and hinge teeth. It appears to be nameless, so is here distinguished as *Cosa* nov., the type designated being *Hochstetteria costata* Bernard. As to the species *Hochstetteria trapezina* Bernard, it does not seem to belong even to this family; there seems to be confusion in regard to it, for all specimens so named by Suter are referable to *Lissarca*, and it may be that Bernard's shell does really belong there, but this cannot be settled till the type is re-examined.

Family **Mytilidae**. [P. 861]

"*Confusus*" has been recently revived for a small Neozelanic mussel, but it is more appropriate to the state of our knowledge of this family at present. The changes may be tabulated thus:—

Suter (Manual)	Iredale (Commentary)	Oliver. (Ecological Essay)
Genus *Mytilus*		
Subgen. *Eumytilus*	Subgen. *Mytilus*	
M. edulis L.		*M. planulatus* Lamk.
Subgen. *Chloromya*	Subgen. *Perna*	
M. canaliculus		
Subgen. *Aulacomya*		
M. magellanicus	*M. maorianus* nov.	*Brachyodontes maorianus*
Genus *Modiolus*		
M. ater	*M. neozelanicus* nov.	*M. pulex* Lamk.
M. australis	*M. areolatus* Gould	*M. confusus* Angas.
M. fluviatilis		

Oliver's emendations were introduced in the Ecological Paper already referred to (1923 A), and some of them more fully explained later in the *Proc. Mal. Soc.*, vol. 15, p. 181, 1923.

Mytilus edulis Linnè, 1758. [P. 862]

For the Neozelanic species so misnamed, Oliver has introduced a West Australian name, *M. planulatus* Lamk., but this may need reconsideration when long series are brought together and accurately compared. Odhner (1924, p. 60) has also noted differential characters in the muscle-scars between *edulis* L. and New Zealand shells.

Mytilus magellanicus Lamarck, 1819. [P. 865]

For the Neozelanic species Iredale proposed *Mytilus maorianus,* but Oliver has used *Brachyodontes maorianus* without explanation. There does not, in any case, appear to be a valid one, as *Brachidontes* was diagnosed by Swainson thus, "Umbones prominent, not terminal; valves corrugated; hinge margin considerably angulated: teeth many small, crenate." Only species, "*sulcata, En. Meth.* 220, fig. 2." The latest workers on the Mytiloids have placed this and the *maorianus* series in different subgeneric groups, widely separated, *Aulacomya* being the group name for the latter. The ' Miocene " *Mytilus huttoni* Cossmann (*vide* Suter, *N.Z.G.S. Pal. Bull. No. 5,* p. 84, 1917), and its (Oligocene?) ancestor *M. torquatus* Marshall (*Trans. N.Z. Inst.*, vol. 50, p. 271, 1918) do, however, belong to the Australian " *Brachyodontes* " series, being quite like *hirsutus* and *rostratus;* for these shells Iredale has recently advocated the use of *Trichomya* Ihering (1924, p. 196).

Modiolus ater (Zelebor, 1866). [P. 866]

This preoccupied name was emended to *neozelanicus* by Iredale, but Oliver has preferred an Australian name, *M. pulex* Lamk., for the Neozelanic shore shell. An interesting complication appears in the fact that though some Auckland specimens are found fairly agreeing with some Tasmanian ones, the common South Island shells disagree notably. Is it wise to accept, under such circumstances, a Tasmanian name for the Auckland form, and then name the southern New Zealand shell as distinct? Such a procedure has nothing to recommend it, so it seems preferable to use the Neozelanic name for the whole of the New Zealand shells, and leave the Australian name for Australian specimens—at all events till the animals are anatomically critically compared. It may be noted that as a synonym of the Neozelanic " *ater,*" Suter included *Perna confusa* Angas, which Oliver is now putting forward as the correct name for a different New Zealand species.

Modiolus fluviatilis (Hutton, 1878). [P. 867]

Oliver has proposed to replace this with *M. confusus,* based on *Perna confusa* Angas, described from the Parramatta River, Sydney, New South Wales. In this case one has little hesitation in rejecting the Australian name, as Suter noted in his " Key to the Species " " Beaks a short distance from the anterior end," a feature well marked in all the forms of the Neozelanic species, but missing in

most of the Australian forms. It should be noted that these molluscs are variable according to their environment, and in some places colonies of constant forms may be collected, differing from their nearest neighbours more than from many distant colonies; a similar fortuitous likeness between a few specimens of two regional forms is insufficient evidence for uniting species described from localities nearly two thousand miles apart.

Modiolaria barbata (Reeve, 1858). [P. 868]

For this shell Iredale has provided the generic name *Trichomusculus* (1924, p. 196); series of Australian and New Zealand forms should be compared, but I have so far failed to pick specific differences.

Lithophaga truncata (Gray, 1843) [P. 870]

This shell is a *Lithophaga* only in the widest sense. In its anomalous shape, absence of radial sculpture except for a few scratches under the beaks, and bark-like epidermal layer, crassly thickened and produced posteriorly, it differs considerably from true *Lithophaga*. I provide for it alone the new generic name *Zelithophaga;* the " Miocene " *L. nelsoniana* Suter may possibly be congeneric, but I would not include *L. striata* Hutton, the figure of which is more like an *Amygdalum;* neither species has been seen.

Pecten medius Lamarck, 1819. [P. 874]

An investigation made by Iredale (1924, p. 193) into the forms grouped under *Pecten medius* showed much of interest. The Lamarckian name was invalid, and a substitute had to be found. Study of the material in the British Museum showed certainly that recognizable forms, species, or subspecies, existed. Criticism of long series in Australia proved that the forms were well defined, so that Tate's early conclusions were fully confirmed. The Neozelanic species agrees neither with the Sydney form, *P. fumatus* Reeve, nor with the Tasmanian species, *P. meridionalis* Tate. Reeve's name of *Pecten novaezelandiae* (*Conch. Icon.*, vol. 8; Pl. 8, f. 36, 1852) is available and must be used; I have not noted any subspecific variation in New Zealand, but the Pliocene (Castlecliffian) ancestral form is notably different from the Recent shells. For *novaezelandiae* Reeve I propose the new group name *Notovola* to contain the austral " *medius* " assemblage, as it cannot be satisfactorily referred to either *Pecten* s. str. or *Euvola* Dall. It seems rather nearer the former, though possessing characters of both groups, and as the austral forms occupy a homogeneous geographical region widely removed from the areas covered by *Pecten* (North Europe) and *Euvola* (West Indies and America), it seems best to mark the differences by a separate group name. Woodring (Miocene Molluscs from Bowden, *Carnegie Inst. Wash. Pub. No. 366,* p. 63, 1925) has lately stated that *Euvola* (Type: *Ostrea ziczac* L.) " differs from *Pecten* s.s. in having a more inflated right valve, weaker radial sculpture, and only one pair of cardinal crura." *Notovola* has the inflated right valve, but strong (though simple) radial sculpture, and especially is different, and more like *Pecten,* in having 3-4 pairs of cardinal crura. These are, however,

not quite so strong as in *Pecten,* the inner ones shorter and the outer ones considerably longer, due to the greater length of the whole hinge-line and auricles; the left valve is not at all inflated and has not the strong secondary radial ridges on the main ribs (*meridionalis* has very weak ridges, the other species are practically smooth); the right valve also has none of the strong secondary ridges characteristic of *Pecten maxima* L., the type of *Pecten,* the ribs are higher and flatter, and the interstices deeper, smooth, and narrower. The shells from the Kermadecs recorded by Oliver (*Trans. N.Z. Inst.,* vol. 47, p. 553, 1915) as *Pecten medius* Lamk. will almost certainly show, when re-examined, regional differences from *novaezelandiae* Reeve, which is probably endemic to New Zealand. Marwick has noted (*Gedenboek Verbeek,* p. 375, 1925) that this type of *Pecten* has appeared in New Zealand only since the Upper Pliocene, and has suggested that ocean currents may be responsible for this.

Genus **Chlamys** Bolten, 1798. [P. 875]

Three more Recent species have to be added to the Neozelanic list; *C. subantarctica* Hedley (1916, p. 23) (a very large species described from Macquarie Island and compared to the Australian *C. anti-australis* Tate); *C. campbellica* Odhner (1924, p. 61) (from Campbell Island, compared with the West Patagonian *C. patagonicus* King and the New Zealand Pliocene *Pecten triphooki* Zittel, which, however, is not a typical *Chlamys*); and *C. consociata* Smith (1915, p. 89) (from 70–100 f. north of New Zealand, compared with *zelandiae,* and apparently overlooked since its description).

For the specific name of one of the species Suter has wrongly written "*imparvicostatus,*" the correct name for Bavay's shell is *Chlamys imparicostatus.*

A large number of new Tertiary species and notes on described species have been added lately, but as the generic grouping is in a chaotic state, and Dr. Marwick is outlining a more satisfactory arrangement in his Report on the Chatham fossils, mention of these would be superfluous and of little use here. Nomenclatural notes on several New Zealand Tertiary species will be found elsewhere in this volume.

Genus **Cyclopecten** Verrill, 1897. [P. 880]

True *Cyclopecten* has not yet been recorded from New Zealand, though an undescribed species like the Australian *favus* and *obliquus* is known to me from deep water in the North. The name "*Pecten aviculoides* Smith," included by Suter, may be easily dismissed; the type is from a locality a third of the globe distant, and Suter's identification is probably based on a juvenile *Chlamys convexus.*

Pecten transenna Suter has a peculiar facies quite different from that of true *Cyclopecten;* it is rhomboidal, the ears are not marked on the right valve and only slightly on the left, and both valves have the same sculpture of strong, rather distant nodulous ribs, while the texture of the shell differs from that of *Cyclopecten,* being similar to that of a young *Chlamys.* I supply for it the new generic name *Cyclochlamys,* and mention as a second member a shell described and well figured by Miss Mestayer (*Trans. N.Z. Inst.,* vol. 51, p. 135,

1919), but misidentified by her as Suter's species; it differs from *transenna* in its much larger size, and in having about twice as many ribs. I propose for it the name *Cyclochlamys secundus* n. sp. Suter's drawing of *transenna* gives the appearance of his species quite well, and his specimens were adult, numerous topotypes I have examined not reaching any larger size.

Genus **Spondylus** Linné, 1758.

This does not occur in the Recent fauna, but Marshall (*Trans. N.Z. Inst.*, vol. 50, p. 271, 1918) has described a Tertiary member, *S. aucklandicus;* other species are known to me, and Woods (1917) has reported a *Spondylus* sp. from Upper Cretaceous beds.

Lima lima (Linné, 1758). [P. 883]

Sowerby described a *Lima zealandica; (Proc. Zool. Soc.* for 1876, p. 754); this has wrongly been lumped in with *Lima squamosa*= *L. lima* (L.), but it is a very distinct species, quite unlike any of the other species confused under the name *L. lima.* Suter seems to have described the Neozelanic specis, but his remarks, "This species has a wide range of distribution, etc." must be omitted altogether.

Suter includes [P. 884] "Subsp. *multicostata*" from the "Bay of Islands" without authority, and this must also be omitted, with all the extract referring thereto. The so-called "*multicostata*" is a common variable Sydney shell, which is certainly a very distinct species from the egregious *L. lima*, and has been renamed *Lima nimbifer* by Iredale (1924, p. 195).

In the Dominion Museum is a specimen from Foveaux Strait named *Lima multicostata*, and this proves to be identical with *L. mestayerae* Marwick (*Trans. N.Z. Inst.*, vol. 55, p. 192, 1924), originally described as a Pliocene fossil from the clays below the limestone at Petane; all Recent specimens of "*multicostata*" from New Zealand are probably this species. A closely-allied ancestral form is *L. watersi* Marwick (*l.c.*, vol. 56, p. 329, 1926). Woods (1917) has described a Cretaceous species as *L. marlburiensis.*

Lima angulata Sowerby, 1843. [P. 885]

Mantellum, H. & A. Ad., 1858 should be used generically for this kind of *Lima.*

The specific name given by Sowerby proves to have been anticipated by Munster (*Beitr. Petref. Kunde*, vol. 4, p. 73, 1841), and the next name, if the species be widely dispersed, is *basilanica* Ad. & Reeve, 1850 (*Voy. "Samarang,"* pt. 7, p. 75), as cited by Suter. But Powell (*Rec. Cant. Mus.*, vol. 3, pt. 1, p. 48, 1926) has recently preferred the name *Lima murrayi* Smith (*Proc. Zool. Soc.* for 1891, p. 444) for shells from 100 f. off Lyttelton. This name (of which *Limea acclinis* Hedley—misspelt *Lima acclinus* by Powell—is a synonym) was given to Australian shells from much deeper water, but seems preferable to any other at present. The species is not uncommon in 60 f. off Otago Heads, where it reaches a length of 14 mm.; most specimens are relatively longer than Powell's figure. The Tertiary forms identified as *L. angulata* by Suter represent, as Powell has noted, a different branch of *Mantellum*, which is appar-

ently unrepresented in our Recent fauna; he has described the Castlecliffian form as *Lima marwicki* (*l.c.*), while a direct ancestor to this has been described by Marwick as *Mantellum inconspicuum* (*Trans. N.Z. Inst.*, vol. 56, p. 311, 1926), and a related Tertiary Australian species by Tate (*Trans. Roy. Soc. S.A.*, vol. 8, p. 119, 1886) as *Lima polynema*. Suter and others wrongly give the type of *Mantellum* as *Ostrea hians* Gm.; it should be *O. inflata* Gm., as pointed out by Woodring (1925, p. 80).

Lima bullata (Born, 1780). [P. 886]

The specific name was given to a West Indian shell, and Hedley has preferred *strangei* Sowerby for the Australian species. Curiously enough, Thiele, when monographing the group, admitted *bullata* as an Australian shell, ranking *strangei* as a synonym, and then for a young individual introduced a new species *jacksonensis*. *Limatula* S. V. Wood, 1839 should be applied generically to this group, and the New Zealand shell must receive a distinct name for it differs at sight from the Australian *strangei*.

Limatula maoria n. sp. (Figs. 104-106).

Shell close to *L. strangei* Sow., but differing in outline, being less slender, more oblique, and more evenly rounded basally. Sides not nicked in so much below auricles, so that these are less prominent; dorsal margin straighter. Radial ribs lower and blunter, closer and more numerous, 25 as against 19 in Australian shells. Internally, a median sulcus is absent or very feeble in *strangei*, but is distinct in the new species at all stages of growth.

Height, 33 mm.; diameter, 20.5 mm.

Locality,—Castlecliff beds (Upper Pliocene), type (fig. 106); off Otago Heads in 60 fathoms, figd. paratypes (Figs. 104, 105), not uncommon throughout New Zealand in water of moderate depth.

The median sulcus has been responsible for the identification of juveniles of this species as *L. suteri* Dall by both Suter and later workers; but the latter species has about 16 ribs on each valve, the termination of sculpture on each side is less well defined, and the sulcus is external, so that the interior shows a strong medial rib with another strong one on each side; *maoria* shows a medial groove with a strong rib on each side. As ancestral to this species in New Zealand may be named *Limatula trulla* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 311, 1926) and *Lima* (*Limatula*) *huttoni* Woods (1917, p. 26), a Cretaceous form which has been renamed *L. woodsi* by Suter on account of preoccupation; see note elsewhere in this volume. An Australian form ancestral to *strangei* Sow., *L. jeffreysiana* Tate has rightly been rejected by Marwick from the New Zealand Tertiary fauna *Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 323, 1924); the differential features between *maoria* and *strangei* seem to be continued throughout the lineages.

Genus **Limea** Bronn, 1831.

I have added this to the Tertiary fauna by recording the Australian *L. transenna* Tate from Ardgowan (*Trans. N.Z. Inst.*, vol. 55, p. 509, 1924); I have had no further opportunity since then of

deciding whether my record was correct, but comparison with actual Australian specimens would probably show the New Zealand shell to be new. The form seems somewhat like the Recent *Limea acclinis* Hedley (*Rec. Austr. Mus.*, vol. 6, p. 46, 1905) later placed as a synonym of *Lima murrayi* Smith, in this form referred to *Limea* by Hedley (*Check-List Mar. Fauna N.S.W.*, p. M 10, 1918), but transferred to *Mantellum* by Iredale (1924, p. 194). Perhaps the fossil species is a *Notolimea* (Iredale, 1924, p. 194; proposed for *Lima australis* Smith), but I have seen no specimens of this genus.

Genus **Ostrea** Linné, 1758. [P. 887]

I am supplying some notes on this in a Report on the Chatham Island Recent shells, so merely record here that Oliver (*Proc. Mal. Soc.*, vol. 15, p. 182, 1923) has discussed the species *angasi, tatei, corrugata*, and *reniformis;* Hedley (*N.Z. Journ. Sci. & Tech.*, vol. 2, No. 6, p. 365, 1919) has given his impressions of the rock-oyster fishery of Auckland, identifying the species concerned (which Suter has called *glomerata* Gould) as *O. cucullata* Born; Iredale (1924, p. 192) has rejected this last name as exotic, and reverted to the use of *glomerata* Gould for the sheltered shore and mangrove form, *mordax* Gould applying to the ocean reef species, and has noted that the New Zealand shell called *angasi* appears to be a distinct species; and Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 324, 1924) has removed two Australian Tertiary species *arenicola* and *manubriata* Tate from New Zealand faunal lists. Woods (1917, p. 25) has identified a Cretaceous species as *Ostrea* sp. cf. *dichotoma* Bayle.

Pinna zelandica Gray, 1835. [P. 893]

Hedley (*Rec. Austr. Mus.*, vol. 14, p. 142, 1924) has written, "Suter has unfortunately transferred *Pinna zelandica* Gray to *Atrina,* whereas it really is, as Gray said, a *Pinna.* On the other hand, *P. senticosa* Gould is probably an *Atrina.*" Finlay (*Trans. N.Z. Inst.*, vol. 55, p. 518, 1924) and Bucknill (1924, p. 95) have recorded that the species reaches a larger size than given by Suter. Murdoch (*Trans. N.Z. Inst.*, vol. 55, p. 157, 158, 1924) has dealt with and figured the two Tertiary species (*P. distans* Hutton and *P. lata* Hutton) so far described from New Zealand. Woods (1917, p. 28) has recorded, but not named, a species from the Upper Cretaceous, which Wilckens (1920) states is also found in South Patagonia and Antarctica.

Hedley's statement needs investigation. There seems at present to be no evidence of the occurrence of a true *Pinna* in New Zealand; only one member of the Family seems to be known to collectors, and that is the common *Atrina* which has always been regarded as *A. zelandica.* The two fossil species are both Atrinas.

Modiolarca trapezina (Lamarck, 1836). [P. 896]

The original spelling was *trapesina,* but that does not concern us much since Hedley (1916, p. 25) has described the Macquarie Island shell as *Gaimardia trapezina* var. *coccinea,* and the examination of many specimens from the Falkland Islands convinces one that the

Neozelanic shell is easily recognizable as a distinct species, *Gaimardia coccinea* Hedley.

Modiolarca tasmanica Beddome, 1881. [P. 896]

The Bounty Island shell so determined by Suter differs from the typical Australian shell, which Odhner (1924, p. 66) has determined as a *Neogaimardia,* while the New Zealand forms so called are true *Gaimardia.* Two closely allied species occur, one from Auckland Island, the other from the mainland, both described below.

Gaimardia forsteriana n. sp.

Shell very similar to *G. tasmanica,* but considerably smaller (none of a large number of specimens examined reaches 5 mm. in length), rostrum narrower and placed lower down, the base much less sinuous, only slightly bulging downwards past the rostrum; no signs of posterior sulcations.

Length, 4 mm.; height, 3 mm.; width (2 valves), 2.2 mm.

Locality,—Taieri Beach, South Island, in seaweed at half tide.

Gaimardia aucklandica n. sp. (Figs. 122-124).

Shell closely related to the previous species, but much less inflated, with a still less developed rostrum. Anterior dorsal margin straight, hardly excavated below the beaks, this makes the rostrum almost completely triangular. Basal margin adds to this effect by being still less sinuated. Colour lighter brownish-red than in *forsteriana,* and the beaks more anterior.

Length, 4.5 mm.; height, 3.3 mm.; width (2 valves), 2 mm.

Locality,—Auckland Island, common. Also Bounty and Antipodes Islands (rather more inflated than type).

This is what Odhner has misidentified as *M. acrobeles* Suter, and this explains his puzzling reference of that species to *Gaimardia;* all his remarks on the anatomy and shell of *acrobeles* refer really to *aucklandica,* and in his work this name should be everywhere substituted for *acrobeles.*

Genus **Kidderia**

This genus has been used by Hedley to include a new species from Macquarie Island, which he named *Kidderia macquariensis,* and Gould's *Mytilus pusillus,* described from Patagonia, which he refigured from Macquarie Island (1916, p. 26; Pl. 2, figs. 23-27). Suter included *Modiolarca pusilla* Gould from "Cape Saunders (Iredale), Antipodes Island., Campbell Island, and Macquarie Island." In the British Museum are specimens of Gould's species "named from the typical shells," and these differ according to Iredale from the ones he collected on the Otago Coast. As Macgillivray *(Hist Moll. Anim. Aberd.,* p. 206, 1843) had anticipated Gould in his usage of *Mytilus pusillus,* I propose to name the Macquarie Island specimens described and figured by Hedley, *Kidderia hamiltoni* n. sp. I would further include in the genus *Modiolarca smithi* Suter, also figured by Hedley *(loc. cit.,* p. 24; Pl. 2, figs. 17-19), and *M. acrobeles* Suter. Odhner (1924, p. 66) refers to and figures the hinge of the latter

species as a *Gaimardia**, but topotypes (two of which are here figured: figs. 102, 103) show it to be close to ***hamiltoni*** in shape, while allied to *macquariensis* by the occasional presence of a few weak threads across the centre of the shell. Odhner has added another closely allied species, *K. campbellica* nov. (1924, p. 67), so that there are now five species recorded from the Neozelanic region, *macquariensis* Hedley, *hamiltoni* Finlay, *campbellica* Odhner, *acrobeles* (Suter), and *smithi* (Suter)—all restricted to the Rossian province.

Costokidderia n. gen.

I propose this for the shell Odhner has described as *Kidderia costata* nov. from Auckland Island (1924, p. 68). This species shows as Odhner has remarked, affinity with *Kidderia* in its shape and hinge, but has strong radial sculpture. True *Kidderia* has only occasionally a few weak threads across the centre of the valve (e.g., *macquariensis* and *acrobeles)*, in the new genus the shell has strong ridges over the whole surface except for a small smooth anterior area. The genus has probably been overlooked as the young of *Cardita* which it much resembles, but there are several Neozelanic members, of which two are described below. Shells very close to *C. costata* occur on the mainland (littoral seaweed-washings from Taieri Beach), but will probably prove separable when ample material is obtained. Odhner has noted "fourteen strong radiating costae," five in the middle and nine on the posterior end, but he had only one specimen, and this sculpture is not the normal one in Auckland Island shells; there are usually about six very strong posterior and dorsal ribs, with 4-6 almost obsolete central ribs; occasionally the ribs are subequal in strength, and often there are only the few prominent posterior ones. I refigure the species from topotypes to show this variation (figs. 99-101).

Costokidderia pedica n. sp. (Figs. 96-98).

Differs from *costata* Odhner in being less elongate, more expanded posteriorly, and more finely sculptured. Fourteen subequal ribs strongly pectinate the margins; interstices sublinear (ribs of *costata* hardly extend beyond the edges and have subequal interstices). Interior as in *costata*.

Length, 3.8 mm.; height, 2.8 mm.

Locality,—Snares Islands, in 50 fathoms.

Costokidderia pedica n. sp. (Figs. 96-98).

Allied to the last in its fairly wide shell, which, however, is far more regularly quadrilateral, all four sides being fairly straight, so that the basal margin is much more distinctly angled posteriorly than in *pedica*. Anterior end is more produced and less rostrate. Sculpture coarser, more as in *costata*, but the ribs of even strength. Twelve subequal ribs, those in centre hardly weaker, interstices a little narrower. Other details as in *costata* and *pedica*.

Length, 3.7 mm.; height, 2.7 mm.

Locality,—Lyall Bay, in shell-sand.

*Since this was written, I have received specimens from Odhner, so identified, which explain this discrepancy, for his shells are not *acrobeles* at all, but *Gaimardia aucklandica* Finlay.

Genus **Neogaimardia** Odhner, 1924.

This is constituted by Odhner (1924, p. 64) for the Australian *Kellia rostellata* Tate, which at the same time he records from New Zealand. Actual specimens sent by Odhner from Cape Maria van Diemen do not agree in shape with Tate's original figure, nor with Odhner's own illustrations — probably drawn from Australian material. I therefore reject the record, and regard the New Zealand species as at present undescribed.

The acceptance of *Neogaimardia* solves another much disputed problem. The status of *Modiolarca minutissima* Iredale (*Trans. N.Z. Inst.*, vol. 40, p. 387, 1908) has caused an amount of debate remarkable for so tiny a shell. Oliver has lately summarized the position (*Proc. Mal. Soc.*, vol. 15, p. 183, 1923) as follows:—" Iredale described this species as a *Modiolarca*. Suter reduced it to *Lasaea miliaris*. Iredale next asserts that his species is a *Modiolarca*, and a valid species, and lists it as *Gaimardia minutissima*. If, before making this statement, Iredale had examined specimens, he could not have repeated his error. The species is correctly placed by Suter under *Lasaea*, but is certainly not *Lasaea miliaris*." Now the type of *Lasaea* is the British *Cardium rubrum* Montagu, to which the Australian *L. australis* is very similar, and these shells differ so much in hinge, texture, shape, and general facies from *minutissima* (of which I have author's paratypes), that one is tempted to remark that if, before making his statement, Oliver had compared specimens he could not have made this error. Iredale's location in *Gaimardia* is much nearer the truth, but the form is, of course, atypical, and differs from *Gaimardia* s. str. in the very details which make it referable to *Neogaimardia*. It may be remarked that Tate's original figure of *K. rostellata* resembles much more the Forsterian *minutissima* than it does the Cookian shells Odhner has referred to *rostellata*.

A fossil species (Pliocene) occurs at Titirangi, Chatham Islands, and will be described by Marwick in his report.

Crassatellites bellulus (A. Adams, 1854). [P. 898]

Powell has lately recorded this shell from off Great Barrier Island in 30-40 fathoms (*N.Z. Journ. Sci. & Tech.*, vol. 6, nos. 5 and 6, p. 286, 1924), and under the name *Crassatella aurora* Ad. & Ang. —a record that I reject—Odhner has described and well figured the same species (1924, p. 72; Pl. 2, figs. 40, 41), adopting Lamy's restoration of the name *Crassatella*. Iredale has, however, shown (1924, pp. 202-204) that there are several austral series included under " *Crassatellites* " auct., all separable from Northern groups. He has provided *Talabrica* for *C. aurora* Ad. & Ang., and this name can be used for *bellulus* A.Ad., and for the Tertiary *Eucrassatella media* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 311, 1926), and probably *C. cordiformis* Suter (*N.Z.G.S. Pal. Bull. No. 5*, p. 72, 1917). *Salaputium* Iredale, given to a large series of Australian minute forms, has as yet no Neozelanic representative. *Eucrassatella* Iredale was bestowed on the large crass forms, *C. kingicola* Lk. being taken as type, and here will be located the Tertiary species *amplus* Zittel (*Voy. " Novara," Pal.*, p. 46, 1865) and *attenuatus* Hutton (*Cat.*

Tert. Moll., p. 24, 1873). For the remaining Neozelanic forms and a number of new species I have introduced a fourth genus *Spissatella* (*Trans. N.Z. Inst.*, vol. 56, p. 256, 1926), with type *Crassatella trailli* Hutton.

Cuna delta (Tate and May, 1900). [P. 902]

Suter's figures are rough copies of Hedley's drawings in *Rec. Austr. Mus.*, vol. 4, no. 1, p. 23, 1901, and therefore represent the Australian shell, with which New Zealand examples do not agree. To eliminate this record I describe one new species from the Snares Islands, but there are several in New Zealand waters awaiting description.

Cuna laqueus n. sp. (Figs. 90-92).

Shell similar in general style to *C. delta* (T. & M.), but relatively much wider, larger, and less inflated. 9-10 weak radiating costae, interstices narrower but widening towards margin, where ribs flatten out and become obsolete; ribs clearly visible in interior as strong grooves. Shell as wide as high, flattened.

Height, 2.6 mm.; width, 2.6 mm.; thickness (2 valves) 1 mm.

Locality,—Snares Islands, in 50 fathoms.

Cardita calyculata (Linné, 1758). [P. 903]

There are at least two Recent species of *Cardita* in New Zealand, neither of which can be merged in the Linnean *Chama calyculata*, and this name should be erased from the lists. I describe both these as new species; the northern one (*Cardita brookesi*) is nearest *C. variegata* Brug. but is distinct, while the southern one (*C. aoteana*) is allied to the Tasmanian form called *calyculata*, but again is distinct. Both species are easily separable from the Peronian form by the wider interstices between the ribs; in Sydney shells the ribs, especially anteriorly and on the upper half, are separated by linear grooves, in New Zealand specimens the ribs are narrow, and have always interspaces almost their own width.

Cardita brookesi n. sp. (Figs. 116-118).

Shell like *C. variegata*, but smaller and with a much more deeply indented basal margin and byssal excavation; not maculated with brown spots, but uniformly light-tawny coloured. 18 ribs as against about 23 in *variegata*, not minutely serrated along their edges; interstices narrow but not linear. There are only three ribs below lunule down to basal margin, and the ribs over the posterior swollen angulation are almost straight instead of curved inwards as in *variegata*. Shell rather short dorso-ventrally, but very inflated; basal margin deeply concave and the valve edges much sunken at byssal area.

Length, 12 mm.; height, 6.5 mm.; width (2 valves) 7 mm.

Locality,—Whangaroa Harbour, collected by A. E. Brookes.

Cardita aoteana n. sp. (Figs. 114, 115).

Shell rather large, winged posteriorly, with coarse ribs, rusty-sienna coloured. Beaks generally quite anterior; anterior side vertical, basal margin only slightly concave, and with very little byssal

excavation, dorsal margin rising posteriorly and forming a Mytiloid wing. 14 coarse ribs, interstices almost as wide over whole shell: lunule lanceolate, with only one rib between it and basal margin, next six ribs low and weak, then three very strong and broader ribs on posterior swollen angulation, then four progressively weaker ribs on wing; ribs weakly lamellose, with rather distant low tubular spines.

Length, 27 mm.; height, 15 mm.; width (2 valves), 16 mm.

Locality,—Dunedin Harbour, attached to rocks on the littoral at low water (type). Throughout New Zealand, and down to 60 fathoms in the South Island.

The Tasmanian form (*Mytilicardia tasmanica* T.-Woods) has a quite different contour and apparently still fewer ribs, which, however, have (as in *aoteana*) wide interstices.

Genus **Venericardia** Lamarck, 1801. [P. 904]

Some corrections are here necessary in the specific values. It has been questioned whether *V. difficilis* Deshayes should be regarded as a distinct species from *V. purpurata* Desh.; the difficulty may be settled by regarding *difficilis* trinomially as a bathymetric form of the littoral *purpurata*, for one is evidently a derivative of the other. Judging from the extensive series I have examined there is no difficulty in picking a shore shell from a dredged one, the ribs are constantly narrower and sharper and with stronger prickles in the bathymetric form. An ancestral form is *V. urutiensis* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 330, 1926).

V. amabilis Desh. should be unhesitatingly dismissed from the fauna; though originally recorded from "New Zealand," it is an Australian species, and an error of localization must have occurred.

Cardita zelandica Desh., 1854 is not preoccupied by *Venericardia zelandica* Potiez and Michaud, 1838, the different generic location being sufficient to validate Deshayes's name. Consequently, Hutton's name *lutea,* proposed as a substitute for *zelandica* Desh. on this account, is unnecessary, and though Hedley (*Trans. N.Z. Inst.*, vol. 38, p. 73, 1906) and Iredale (1915, p. 487) both used *lutea,* I regard retention of the original name as correct.

Venericardia bollonsi Suter, 1907 cannot be even trinomially separated from *V. zelandica* Desh. Topotypes and numerous specimens from off Otago Heads (the other locality given by Suter) have been compared with extensive series from localities all over the Dominion, and there is no doubt that all the shells belong to one species, extending in range from North Cape to Stewart Island. I have not yet met with it, however, in either the Moriorian or Rossian provinces, though it probably occurs in the former; the numerous specimens seen from the latter all belong to *Venericardia marshalli* Marwick. This name was rightly provided (*Trans. N.Z. Inst.*, vol. 55, p. 192, 1924) for Stewart Island shells referred to the European *V. corbis* Phil. by Suter. It is essentially a deep-water Rossian and south Forsterian form, common off Auckland, Snares, and Stewart Islands, and Otago Heads, but I have not met with it any further north. In the North Island occurs an allied new species to which Suter's Hauraki Gulf records probably refer. Whereas *zelandica* (=*lutea*) has commonly

18 (sometimes 16 or 17) ribs, with numerous small horizontally elongate granules, *marshalli* has usually 12 (occasionally 11 or 13) ribs, often ill-developed, and rather weakly granose.

Loripes concinna Hutton, 1885. [P. 912]

Although Iredale in his "Commentary" indicated the rejection of the name *Loripes* in favour of *Lucinida,* he did not question the reference of the Neozelanic species to the genus. Upon examining the species one finds that it has little relationship with the named genus, but that it is allied to the Australian shells formerly classed in *Myrtaea,* for which Iredale has proposed the name *Notomyrtea* (1924, p. 206); specifically it is quite close to the South Australian *Myrtaea bractea* Hedley *(Zool. Res. Endeavour,* pt. 1, p. 99, 1911). *Bractea* and *concinna* differ somewhat from the type of *Notomyrtea* (*botanica* Hedley) in having no radial sculpture, and may later prove separable; a quite typical species has, however, been described from Tertiary beds—*Myrtaea* (*Eulopia*) *papatikiensis* Marwick *(Trans. N.Z. Inst.,* vol. 56, p. 330, 1926)—and others are known to me.

A series of New Zealand shells, however, including *Cyclina dispar* Hutton (= *Lucinida laevifoliata* M. & M.; *vide* Marwick, *Trans. N.Z. Inst.,* vol. 55, p. 193, 1924), *Lucinida tirangiensis* Marwick *(Trans. N.Z. Inst.,* vol. 56, p. 330, 1926), *Chione auriculata* Bartrum *(Trans. N.Z. Inst.,* vol. 51. p. 97, 1919; *vide* Finlay, *Trans. N.Z. Inst.,* vol. 55, p. 538, footnote, 1924), and *Loripes laminata* Hutton (*Trans. N.Z. Inst.,* vol. 17, p. 331, 1885) need subgeneric recognition on account of peculiar sculpture, large shell, and anterior wing; for these I suggest the name *Pteromyrtea* nov., naming *C. dispar* Hutton as type. Suter's figure of *laminata (N.Z. Geol. Surv. Bull, No. 3,* Pl. 8, figs. 19a, b, 1915) is very little like this species, and really represents an undescribed species of *Notomyrtea* common in Oamaru "Miocene" beds. Ancestral new species to both this and *concinna* are known to me from as far back as the Palaeocene in New Zealand.

Woods (1917, p. 29) has described a Cretaceous Lucinoid as *Lucina cantaburiensis.*

Montacuta triquetra* Suter, 1913. [P. 918]

The genus to which this shell is referred was founded on a small British bivalve which is but little like the New Zealand form. I know of at least two other undescribed Recent allies, while a form directly ancestral to *triquetra* occurs in the Pukeuri "Miocene" beds, so one need not hesitate to found a new genus *Parvithracia,* with *M. triquetra* Suter as type. The pallial line is not "continuous and simple" as Suter describes, but has a deep sinus; the whole aspect of the shell is that of a miniature *Thracia,* near which genus I would provisionally place it.

Family **Diplodontidae.** [P. 915]

The genus *Diplodonta* may be dismissed from the Neozelanic fauna. There is a prior *Diplodon;* and it may be noted in passing

*See nomenclatural note and new name elsewhere in this volume.

that Dr. Allan Thomson has erroneously used *Diplodon* in one of his papers instead of *Diplodonta* (*Trans. N.Z. Inst.*, vol. 52, p. 391, 1920). I propose the new generic term *Zemysia*, naming *Lucina zelandica* Gray as type and quoting *Diplodonta infrequens* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 312, 1926) in lineage. There may be more than the three species allowed by Suter, but these comprise two series and the names need correction.

Although Hedley, May, and Suter decided that Gray's *Lucina zelandica* was conspecific with *Diplodonta tasmanica* Ten.-Woods, more material has negatived the conclusion. There are constant differences in outline and inflation, and since ancestors of these species are found in the Tertiary with the same characteristics, it is evident that different species have developed. I have not the material to institute sufficient comparison between *D. tasmanica* Ten.-Woods and *D. ampla* (Hutton) (*Trans. N.Z. Inst.*, vol. 17, p. 323, 1885), but the latter Pliocene form would seem to be a closer ally to the Tasmanian shell than is *D. zelandica.*

"*Lucina novae-zelandiae* Reeve" appears in Reeve's work really as *Lucina novo-zelandica*, and the reference should be to Plate 9, fig. 14, where a globose shell with a brown epidermis is described; it looks like a *Joannisiella*, and is certainly not the Neozelanic shell recorded as *D. striata* Hutton. Hutton's name was simply proposed as a substitute for Reeve's name, on account of the prior *zelandica* Gray, so that the species needs description as new; I describe it below as *Zemysia striatula* nov.

"*Diplodonta globularis* Lamarck, 1818" included by Suter, is here also described as a new species (*Z. globus* nov.), for Lamarck's shell was named from King George's Sound, W.A., and is quite different, the Eastern Australian representative known as *globulosa* A.Ad. being different again. These three and *Z. striatula* nov. form an easily recognised branch of the *Zemysia* line (or *vice-versa*), having a hemispherical thin and inflated shell, submedian and inflated beaks overtopping a very narrow hinge-line, and small short teeth, and one may emphasize these differences by providing a new subgeneric name *Zemysina* with *Z. globus* nov. as type. This group also goes far back in the New Zealand Tertiary.

Zemysia (Zemysina) globus n. sp. (Figs. 109-111.)

Shell thin, inflated, subequilateral, horny outside; interior white, dull centrally, shining at margins. Beaks moderately inflated, a little forward of middle; dorsal margins sloping away at subequal angles from umbo, both ends equally rounded, basal margin gently and regularly curved. Sculpture of fine and close growth-laminations. Other details as in *globularis.*

Length, 26 mm.; height, 23.5 mm.; width (1 valve), 8.5 mm.

Locality.—Stewart Island (type). Common in deeper water.

Zemysia (Zemysina) striatula n. sp. (Figs. 112, 113).

Shell small, inflated and globose, not so thin as preceding species. Beak slightly forward of middle; dorsal margins very slowly descending; shell subcircular in outline, but a little vertically compressed. Sculpture of irregular flattish concentric ridges, lamellate near

margin. Shell less shining than *globus*, in specimens of same size more inflated, and with a shorter ligament. Other details as given by Suter under "*Diplodonta striata* Hutton."

Length, 14.5 mm.; height, 13.5 mm.; width (1 valve), 6 mm.

Locality,—Auckland Harbour.

Genus **Thyasira** Lamarck, 1818. [P. 918]

Add the Tertiary *T. planata* Mårwick *(Trans. N.Z. Inst.*, vol. 56, p. 331, 1926).

Erycina parva (Deshayes, 1856). [P. 922]

The introduction of Deshayes' species name into Australian lists appears to have been a pure blunder, and Hedley's *acupuncta* has been revived by himself in his *Check-list of the N.S.W. Mollusca*, (1918, p. M 19) while Iredale has commented upon the use of the Lamarckian genus *Erycina*. He concluded that in every case it was inadvisable to continue the usage of that generic name in connection with Australian Recent mollusca, and therefore introduced the generic name *Melliteryx* for Hedley's species alone (1924, p. 207). With this must be associated the Neozelanic *parva* (for which I have recorded a littoral habitat, Dunedin Harbour; *Trans. N.Z. Inst.*, vol. 55, p. 517, 1924), but *Kellia bifurca* Webster belongs to a different series. Though Suter wrote that he had never seen it, Webster's species is a common shell both Recent and fossil, and proves to be a close ally of the form Hedley has described as *Erycina helmsi (Proc. Linn. Soc. N.S.W.*, vol. 39, pt. 4, p. 701, 1915). There are several undescribed fossil forms, while a characteristic of the species seems to be the frequent formation in adolescence of two interior thickened limy patches; I provide for the group the name *Arthritica* nov.; naming *Kellia bifurca* Webster as type.

Genus **Kellia** Turton, 1822. [P. 922]

A Tertiary species has been described as *K. antiqua* Marwick *(Trans. N.Z. Inst.*, vol. 56, p. 312, 1926), but the generic location was made with some doubt.

Genus **Neolepton** Monterosato, 1875. [P. 924]

This is another British group-name wrongly used to cover a compact little assemblage of austral forms, and I propose *Notolepton* nov. to replace it, naming as type *Kellia antipoda* Filhol, of which *K. sanguinea* Hutton is very possibly a synonym. There is considerable variation in shape in one and the same species in these shells, and I cannot satisfactorily separate topotypes of the two species, though there is evidence that more than one form exists. It may be noted that whereas Suter describes *antipodum* as having the anterior end slightly longer, his figure (which is a copy of Hedley's good drawing in *Trans. N.Z. Inst.*, vol. 37, pl. 1, fig. 5) shows it if anything slightly shorter. *N. citrinum* Hutton is a distinct form, while *N. novacambrica* Hedley *(Proc. Linn. Soc. N.S.W.*, vol. 29, p. 701, 1915) would easily enter *Notolepton*. Odhner has given some anatomical details for *N. sanguineum* (Hutton) (1924, p. 75).

Genus **Lasaea** Leach, 1827. [P. 926]

Odhner (1924, p. 78) makes the curious statement that "Oliver (1923) maintains the identity of *L. miliaris* of Suter and *Modiolarca minutissima* of Iredale, as well as the specific distinctness from *L. miliaris* of Philippi." This is not what Oliver intended; all he maintained was that *minutissima* was a *Lasaea,* but was distinct from the species Suter called *miliaris.* This matter has already been discussed under *Neogaimardia. Miliaris* is a Mediterranean shell and must be rejected; in the meantime its place may be taken by *L. consanguinea* Smith, added and figured by Hedley from Macquarie Island (1916, p. 32), but the mainland shells will require a new name. *L. scalaris* Phil. should also be omitted. These matters are dealt with, and new species proposed, in a paper on the Recent Mollusca of the Chatham Islands, shortly to be published.

Myllita stowei (Hutton, 1873). [P. 929]

This species shows a very different facies from the Australian species, which are all circular in shape, though they vary from almost smooth to strongly sculptured forms with extraordinary "ears." I therefore propose to separate this form under the new generic name *Zemyllita,* and suggest its great distinction from the Australian species.

Another discrepant form has lately been described by Marwick as *Myllita finlayi* nov. (*Trans. N.Z. Inst.*, vol. 55, p. 194, 1924), with the remark, "The generic location under *Myllita* is only provisional. The outline and ribbing are not the same as in that genus, but the whole group will be revised later. A closely related unnamed species occurs at Castlecliff." It seems that Dr. Marwick was judging the genus from *M. stowei,* which I have just noted as quite atypical: as a matter of fact *M. finlayi* is quite like *M. tasmanica* in shape and pattern of sculpture, but is a much smaller and far more fragile shell. The style of divarication is that of *Divaricella* rather than that of true *Myllita.* Since *M. finlayi* is known from but a single specimen, I name as type of the new genus *Myllitella* which is now proposed for this group, *M. vivens* n. sp. (Figs. 119, 120, 121), from 25 fathoms off the Hen and Chicken Islands. This Recent form appears to differ from *finlayi* only in smaller size and slightly different contour, but as the intervening Upper Pliocene form from Castlecliff differs again in its more transverse shell, and as a still more transverse form is known to me as a mid-Pliocene fossil from the Chatham Islands, I conclude that further Petane specimens will show abundant differences from the Recent form, and better diagnostic characters may then be given. I know of ancestral forms back to the "Miocene" in New Zealand, but do not at present know of any Australian species that could be included here.

Genus **Rochefortia** Velain, 1878. [P. 930]

Iredale has shown that this genus name, preferred to *Mysella* on the score of priority was not published until later and must be rejected in favour of Angas's name.

Odhner has, by a curious error, provided a name for the Neozelanic shell wrongly recorded by Suter as *R. donaciformis* Angas. Regarding some Stewart Island shells as distinct from ***Montacuta triquetra*** Suter, he described them as ***M. unidentata*** nov. (1924, p. 76), failing to see in them Suter's *R. donaciformis.* Even going by the figures, it is hard to see how one could confound the two groups, but though Odhner's choice of genus was poor, his specific name is acceptable, and the New Zealand shell may now be separated from *donaciformis* under the name *Mysella unidentata* (Odhner). Hedley has added from Macquarie Island *R. charcoti* (Lamy) and *R. macquariensis* nov. (1916, p. 32), and these may be classed in *Mysella,* as, provisionally, may also be the second species of *Montacuta* described by Odhner, *M. tellinula* (1924, p. 77). *R. reniformis* Suter (which I have noted as not uncommon on the littoral, Taieri Beach and Dunedin Harbour; *Trans. N.Z. Inst.,* vol. 55, p. 517, 1924) is, however, a different style of shell; with superficial resemblance to shells Hedley called *Bornia,* it differs in texture, solidity, and somewhat in hinge, so that I give it *Rochefortula* nov. as a generic name for itself, and anticipate the discovery of Tertiary ancestors.

Genus **Cyamium** Philippi, 1845. [P. 932]

This and the sole representative *C. oblongum* Smith, included by Suter, have been rejected by Hedley (1916, p. 26), the shells so determined being there described as *Kidderia macquariensis* nov. (*vide antea,* under *Kidderia).*

Family **Galeommatidae.**

Neozelanic representatives of this family have been known for some time, but Odhner has now definitely introduced it with a new species, *Spaniorinus zelandicus,* from 35 fathoms, Hauraki Gulf, and 45 fathoms, Auckland Island (1924, p. 78). Very full details of anatomy and shell are given, and these show disagreement with *Spaniorinus,* so that it is legitimate to propose *Scintillona* nov. for Odhner's species. The Australian shells called *Solecardia* are close allies, but have a better developed hinge.

Genus **Corneocyclas** Férussac, 1818. [P. 934]

The introduction of this, with a section *Pisidium* Pfeiffer, 1821 [P. 936], is due to Dall's initiative; *Pisidium* is now considered as of generic value, but the New Zealand species need re-examination, especially as to their anatomy.

Family **Tellinidae.** [P. 945]

Considerable rearrangement of the species is necessary here, for Suter's groupings are quite unnatural. I would dismiss *Tellina* s. str. as inapplicable to any New Zealand species, the following association having more affinity with *Macoma* Leach, 1819:—*eugonia* Suter, *huttoni* Smith and var. *sterrha* Suter, *gaimardi* Iredale, *edgari* Iredale, *spenceri* Suter, and the "Miocene" *robini* Finlay (*Trans. N.Z. Inst.,* vol. 55, p. 474, 1924).

T. charlottae Smith cannot be classed with this group, having different cardinal teeth, and two subequal valves hardly flexed or

angled anywhere; the free, short, and rapidly ascending sinus prevents reference to *Eurytellina* Fischer, which it otherwise somewhat resembles, nor has it the facies of *Elliptotellina* Cossmann, which has a somewhat similar sinus. It does not seem referable to any austral Tellinid group, and is therefore named as type of a new division *Maoritellina.*

The Australian representative of *T. liliana* Iredale (*T. deltoidalis* Q. & G.) has also been classed as a *Macoma* by Hedley and May, but it differs considerably from the previous group in its hinge, which is far closer to that of *Tellina disculus* Desh.; I would place these two forms near that species, but propose for them the group name *Macomona* nov., with *T. liliana* Iredale as type; the Australian Tertiary *T. basedowi* Tate, which has been compared to *deltoidalis* (*Trans. Roy. Soc. S.A.*, vol. 25, p. 148, 1901), may also be located here. Odhner has for no apparent reason reverted to the usage of *T. deltoidalis* Q. & G. for New Zealand shells. Iredale and E. A. Smith, studying long series, unhesitatingly separated the two forms, and the British Museum recognizes their distinctness; in the face of this action by an austral worker and one of the greatest authorities on bivalves, it is not the wisest course for an extra-limital worker, studying scant material, to unite them, and Australasian students will hardly endorse the action. As, however, it is not known what shell Suter figured, I take this opportunity of illustrating authentic New Zealand examples of *M. liliana* from Stewart Island (figs. 107, 108).

It may be noted that for a peculiar late Tertiary species with heavy hinge, pronounced posterior lateral teeth, and no anterior laterals, Marwick has introduced a genus *Barytellina,* type *B. crassidens* Marwick (*Proc. Mal. Soc.* vol. 16, pt. 1, p. 25, 1924) and I have since described a second member *B. anomalodonta* (*Trans. N.Z. Inst.*, vol. 55, p. 473, 1924).

Tellina disculus Deshayes, 1855. [P. 951]

Oliver has counselled the rejection of *Arcopagia* for this species, and the substitution of *Pseudarcopagia.* But *disculus* is no close relative at all of *Tellina decussata* Lk. (i.e., *P. victoriae* Gat. & Gab.), the type of *Pseudarcopagia,* as the radial sculpture is practically absent, the hinge is not quite in accord, and the pallial sinus shows differences, which are exaggerated by reference to other New Zealand Tellinids. I have already noted that the hinge of *disculus* is quite like that of *Macomona liliana,* which suggests that as a shell form it is a derivative of the older *Macomona,* and may have nothing to do with *Pseudarcopagia.* Accordingly I name *T. disculus* Desh. as type of *Zearcopagia* nov., and suggest that *Pseudarcopagia piratica* Hedley (*Proc. Roy. Geogr. Soc. Aust., S.A. Branch,* p. 7, 1918) is a similar development in West Australian waters.

Genus **Leptomya** A. Ad., 1864 and **Macoma suteri** Smith, 1898. [P. 955]

From consideration of topotypes I would class this in *Leptomya,* as a very near relative of *L. perconfusa* Iredale. From the series seen, I admit it at present as a distinct species, differing slightly in

shape and in much less prominent radial sculpture, but I do not feel at all certain that the comparison of further material will support this, as *perconfusa* is variable in shape, and the Lyttelton shells are somewhat rubbed. Should they prove synonyms, the correct name for the species will be *Leptomya retiaria* (Hutton); the type specimens of *Tellina retiaria* Hutton, 1885 (*Trans. N.Z. Inst.*, vol. 17, p. 322), from the upper Pliocene beds at Castlecliff are in the Canterbury Museum, and are the same species as he described from Recent shells as *Tellina lintea* (*Cat. Mar. Moll.*, p. 67, 1873). This name having been used previously by Conrad, Iredale (1915, p. 489) proposed *L. perconfusa* nom. nov. as a substitute, but this must give way to Hutton's equivalent and earlier *retiaria*. No difference can be picked between Petane (Mid-Pliocene) and Recent shells, nor can regional subspecies be satisfactorily determined in the Recent specimens; it may be noted in this connection that Hedley (1916, p. 29) has reported *perconfusa* from Carnley Harbour, Auckland Is. An older Pliocene form has, however, been differentiated as *L. simplex* Marwick (*Trans. N.Z. Inst.*, vol. 56, p. 331, 1926).

Mesodesma subtriangulatum (Gray, 1825). [P. 957]

Suter admitted three species, *M. subtriangulatum* (Gray), *M. ventricosum* (Gray), and *M. australe* (Gmelin), placing each in a separate subgenus. Iredale reviewed the group in his "Commentary," eliminating *Mesodesma*, preferring *Amphidesma*, and allowing four species, with two subgenera; *A. gaymardi* Desh., *A. quoyi* Desh., and *A. ventricosum* Gray under the subgenus *Taria*, and *A. australe* Gmelin under the subgenus *Paphies*. In the footnote, *A. gaymardi* was corrected to *A. subtriangulatum* Wood. Oliver has since dealt with the matter (*Proc. Mal. Soc.*, vol. 15, pt. 4, p. 186, 1923), but as he has confused distinct forms, his notes require some revision. Suter's confusion as cited by Iredale depended upon Suter's written work, not upon how shells were privately labelled by him. This appears to be clear from Iredale's review, but seems to have been misinterpreted by Oliver. Thus Iredale pointed out that apparently Suter had confused *quoyi* with *ventricosum*, since Suter, in the diagnosis of his *Taria*, which included only the latter, had written, "pallial sinus well marked, *sometimes deep.*" The pallial sinus in true *ventricosum* is *always* deep, so that only one conclusion is possible to account for the use of the word "sometimes," and that is that a species with a short pallial sinus had also been examined. As regards *subtriangulatum*, Oliver apparently wishes to show that the Northern shell ("*quoyi*" Iredale) differs only subspecifically from the southern one ("*gaymardi*" Iredale), because shells from the Chatham Islands indicate variation. Oliver then suggests a usage of the known names which cannot be followed, on account of the fact that all the names were given to the northern form. This is certain from study of the figures alone, so that the southern form, interpreted quite wrongly by Iredale, following Lamy, as *subtriangulatum*, is nameless. The confusion seems to have arisen on account of the fact that there are two bicarinate species; not only *ventricosum*, but its associate *subtriangulatum* also, has in the adult shell a second carina bisecting the posterior dorsal area, whereas the southern form

has none. This solves all the difficulties, for we can now understand how *subtriangulatum* was sometimes lumped with the southern shell (on account of shape and sinus), and sometimes, by Suter, with *ventricosum* (on account of the two carinae); and it further allows one to settle definitely not only the specific distinctness of the form, but also the form referred to by the various figures. Judged by this and other criteria, Wood's figure of *subtriangulatum* certainly represents the northern shell, which must therefore bear his name, with *quoyi* Desh., *latum* Desh., *spissa* Reeve, and *gaymardi* Desh. as synonyms. Further, Oliver's statement that his Upper Pliocene *pliocenica* nov. is "more distinct from the two Recent forms than they are from each other," is negatived, for *pliocenica* possesses no second ridge, and is evidently directly ancestral and quite close to the southern shell, while *subtriangulatum* is considerably different. The mid-Pliocene *crassiformis* M. & M. (*Trans. N.Z. Inst.*, vol. 52, p. 136, 1920) is a still earlier ancestor, also having no second ridge. For sake of convenience, and to obviate further error, I now present a key to the species:—

Shell inequilateral	
Adult shell posteriorly bicarinate.	
Pallial sinus deep	*ventricosa*
„ „ shallow	*subtriangulata*
Adult shell posteriorly unicarinate, sinus shallow.	
Shell very high and crass, posterior dorsal area cut straight in	*crassiformis*
Shell high but not crass, posterior dorsal area moderately cut in	*pliocenica*
Shell neither high nor crass, posterior dorsal area rather expanded	*forsteriana* n. sp.
Shell subequilateral, not carinated	*australis*

I propose the name *Amphidesma forsteriana* n. sp. for the southern species, characterized by inequilateral rather small shell, not high nor crass, nor inflated; rather short anterior end in comparison with *subtriangulata*, and more produced posterior end, the beaks being therefore much less posterior; wing-like expanded posterior dorsal area, not sharply cut in, and with no distinct second medial carination, the bordering main carination being itself weak; and short pallial sinus. A holotype (69 mm. by 48 mm. by 19 mm.—two valves) is selected from Warrington beach, near Dunedin, in the Finlay collection. This species is so distinct from *subtriangulata* at every growth stage that one cannot understand how the two have ever been confounded.

Miss Mestayer (*N.Z. Journ. Sci. & Tech.*, vol. 4, no. 2, p. 84, 1921) has supplied some "Notes on the Habits and Uses of the Toheroa" and states, "there are also one or two beds in the South Island. These may, however, contain a closely allied species." It is probable that she had in mind *A. forsteriana* nov., but, on the other hand, a form of *ventricosum* certainly does occur in the Forsterian region. The few examples I have from Moeraki and Riverton (where I am told it is common) appear to differ trinomially from the Cookian form in the shape of the posterior end, but separation may be left till more material can be compared. Miss Mestayer presents a figure of *ventri-*

cosum which is unnatural; a much better illustration is given by Bucknill (1924; Pl. 12, f. 12) who also gives a good idea of *subtriangulatum* (Pl. 12, p. 13) except that the second carina is indistinct in both cases. I have seen Forsterian examples of the latter species also; they may, however, prove trinomially separable.

Mesodesma australe (Gmelin, 1791). [P. 969]

In his Ecological Essay, Oliver has sometimes used *Amphidesma australe,* at others *A. novaezelandiae* without indication as to whether emendation is intended or merely a slip made. It is a little unfortunate that Oliver in this essay has, without published explanation, introduced so many nomenclatural changes, sometimes unncessary, and occasionally incorrect. Name changes are always annoying, but, however necessary, should really not be introduced in the absence of simultaneous adequate explanation. Apart from this, the wealth of information stamps Oliver's work as one of the best that has appeared on this subject, and one that will undoubtedly stimulate much fruitful search. As regards *Amphidesma australis,* no specific change is, of course, necessary, but the use of *Paphies* generically may be advocated, while the Auckland Is. var. *aucklandica* is almost distinct enough to be regarded as a second good species. If regarded as of only regional subspecific rank, it should be written trinomially, *Paphies australis aucklandica.*

Genus **Raeta** Gray, 1853. [P. 969]

Oliver *(Proc. Mal. Soc.,* vol. 15, p. 184, 1923) has dismissed the Recent species admitted by Suter *(perspicua* Hutton) as based on a specimen of the exotic *R. canaliculata* (Say), but the genus name is still present in the fauna by reason of the Tertiary *Raeta tenuiplicata* Bartrum *(Trans. N.Z. Inst.,* vol. 51, p. 97, 1919); no specimens of this have been available for examination.

Family **Veneridae** Leach.

A full revision (by Dr. Marwick) of the New Zealand members of this family appears elsewhere in this volume; many new genera are proposed. It therefore need only be noted here that Oliver *(Proc. Mal. Soc.,* vol. 15, p. 186, 1923) has dismissed *Bassina disjecta* (Perry) [P. 989] from the New Zealand fauna, and Marwick (*Rep. Austr. Assoc. Adv. Sci.,* vol. 16, p. 322, 1924) has similarly treated an Australian Tertiary form recorded by Suter, *Clausinella subroborata* (Tate).

Dosinia caerulea (Reeve, 1850). [P. 977]

Oliver *(Proc. Mal. Soc.,* vol. 15, p. 188, 1923) has provided *Dosinia maoriana* nov. for the New Zealand shell incorrectly determined as Reeve's species.

Genus **Macrocallista** Meek, 1876. [P. 981]

This will be replaced by *Notocallista* Iredale (1924, p. 210), proposed for the austral forms, with *Callista kingi* Gray as type.

Cytherea creba (Hutton, 1873). [P. 984]

The correct spelling is *crebra,* as appears in the synonymy. When Iredale furnished some remarks on the nomenclature of Venerids, he

followed Suter's acceptance of facts, carefully noting that he did so, pointing out in the case of *C. zelandica* that the species did not appear correctly referable to *Antigona.* Oliver has written *(Proc. Mal. Soc.*, vol. 15, pp. 184-5, 1923) on this matter, and has stated his opinion that *zelandica* and *crebra* should be united, and *oblonga* admitted, and then has added, "As a species, *A. oblonga* is doubtfully distinct from *A. zelandica.*" This conclusion had been arrived at by Deshayes very many years before, from study of the actual types, and had been endorsed by E. A. Smith in the *Voyage of the " Erebus and Terror,"* (p. 6, 1874) fifty years ago, as cited by Suter. Since Suter has also intimated the distinction of the group, I introduce the new generic name *Dosinula,** naming as type *Dosina zelandica* Gray, of which *Venus oblonga* Gray is a synonym. The name *crebra* Hutton may, however, be conveniently retained as a name for the shells which have very broad and inflated beaks with a peculiarly erect set. They are quite distinctive, and occur at Lyall Bay and Hauraki Gulf together with *zelandica,* but are much rarer; I have not seen the form in the South Island, though *zelandica* is plentiful in 30-50 fathoms. As a fossil, *crebra* occurs in the Pliocene of Castle Point, but never at Castlecliff or Nukumaru. These distributional facts seem to warrant its separation. Smith's figures (from types?) of *zelandica* and *oblonga* in *Voy. "Erebus and Terror"* do not include *crebra.*

Chione subsulcata Suter, admitted to the Recent fauna in the "Manual" [P. 985], has nothing to do with this group; it is a restricted mid-Pliocene fossil of the *spissa* type, and must be omitted from the Recent fauna. Suter's Recent records refer to a totally unrelated new species, which has also occurred in deep water off Otago Heads.

Chione stutchburyi (Gray, 1828). [P. 987]

I provide the new generic name *Austrovenus* for this species. It compares well with no other *Chione,* and is a distinctive Neozelanic evolutionary product. It is found fossil from the mid-Pliocene onwards, produced a crass and tumid offshoot in *C. crassitesta* Finlay *(Trans. N.Z. Inst.*, vol. 55, p. 478, 1924), and has a "Miocene" (or earlier) relative in *C. acuminata* Hutton (*N.Z. Geol. Surv. Pal. Bull. No.* 2, p. 51, 1914).

The *spissa* group has had an addition made to it in the form of *C. mawsoni,* described by Hedley from Macquarie Island. (1916, p. 33). This species, *spissa* Desh., and the Pliocene *subsulcata* Suter are related to a well marked Australian series for which Iredale has proposed the genus name *Chioneryx* (1924, p. 210), naming *Erycina cardioides* Lk (= *Antigona striatissima* (Sow.) auct.) as type, but are not quite the same, and have been separated by Marwick.

Paphia fabagella (Deshayes, 1854). [P. 994]

This species, originally named as a *Tapes,* was described from New Zealand, then commonly found in Australia and the Neozelanic habitat rejected as fictitious, then re-found in New Zealand. There

*The new genera of *Veneridae* here proposed were erected before Dr. Marwick's paper was written up, but, owing to delay in publication, appear simultaneously with it.

is still doubt as to the exact identity of the Neozelanic form, but New Zealand specimens in the Australian Museum, assigned to this species, do not agree with Australian forms, having a much longer sinus, and longer and more prominent teeth; the type figured by Reeve is the Tasmanian form, which is like the New Zealand shell, but (though much larger) still with a shorter sinus. Hedley, following Jukes Browne, has classed this species under *Venerupis*, but this seems a bad location. Jukes-Browne included *fabagella* and *galactites* under *Pullastra,* and then added "two species generally assigned to *Venerupis*, viz., *V. rugosa* and *V. siliqua*.... are better placed under *Pullastra* than under *Venerupis*." Oliver has proposed *Notopaphia* for *Venerupis elegans*, citing as diagnostic "the characters of the teeth" and the possession of "a well defined lunule," using the other New Zealand forms as true *Venerupis*, as he follows by stating that *V. reflexa* and *V. siliqua* are inseparable and should be lumped. The extraordinary variation in the teeth makes it difficult to utilize this feature, and the best characters for separating *elegans* appear to be the lunule and the crenulation of the margins. However, as Jukes Browne pointed out, the other austral species are not true *Venerupis,* and as that name is also doubtfully valid for any group, I propose *Irona* nov., naming *V. reflexa* Gray as type, and *Paphirus* nov., naming *Venus largillierti* Phil. as type. This ill-sounding name may have to replace the familiar *Venus intermedia* Q. & G., which Iredale tells me is preoccupied; but since he has sent no details I am unable to verify this statement.

Protocardia pulchella (Gray, 1843). [P. 1000]

The type of *Protocardia (C. hillanum* Sow.) is a European Cretaceous form, while the section *Nemocardium* (type: *C. semiasperum* Desh.; Eocene, Paris Basin) is Suter's location, from perusal of Dall's "Tertiary Mollusks of Florida" (*Trans. Wagn. Free Inst. Sci.*, vol. 3, pt. 5, p. 1078, 1900; Dr. Marwick has kindly pointed out to me that both Dall and Suter wrongly give the page reference to *Nemocardium* Meek as p. 172, whereas it should be p. 167). This stock lived in Australian and New Zealand seas throughout the Tertiary, giving rise to a large series of forms, to cover which Iredale has introduced the genus name *Pratulum* (1924, p. 207), provided for *Cardium thetidis* Hedley, originally proposed merely as a variety of *striatulum* Sow. (=*pulchellum* Gray). Iredale, however, did not consider *Nemocardium,* which seems to cover the austral forms so well that the use of *Pratulum* may be postponed until differential characters are adequately pointed out. In direct lineage in New Zealand may be named *Nemocardium semitectum* Marwick *(Trans. N.Z. Inst.,* vol. 56, p. 312, 1926) and new species extending back to the Palaeocene. Oliver *(Proc. Mal. Soc.,* vol. 15, p. 183, 1923) has noted that *pulchella* does not occur at the Kermadecs, the shells he so identified (*Trans. N.Z. Inst.*, vol. 47, p. 556, 1915) being really *Cardium maculosum* Wood.

Some large Tertiary species referred to *Protocardia* will probably prove separable from *Nemocardium,* but may be referred there temporarily. Suter has allowed three species, *patula* (Hutton) *(Cat. Tert. Moll.,* p. 23, 1873), *sera* Hutton *(l.c.),* and *alata* Suter *(N.Z.*

G.S. Pal. Bull. No. 5, p. 78, 1917), but I have noted that there may be only one *(Trans. N.Z. Inst.,* vol. 55, p. 498, 1924). *Cardium patulum* Hutton was described from two localities, Waipara, and Broken River (Lower); I now nominate the latter as the type locality, and this will render *sera,* from the same locality, an absolute synonym; *alata* is from Mt. Brown, and may prove separable when more material is available.

Cardium (Glans) kaiparaensis Marshall *(Trans. N.Z. Inst.,* vol. 50, p. 272, 1918) I have determined *(l.c.,* vol. 55, p. 538, footnote, 1924) as a synonym of *Venericardia subintermedia* Suter *(N.Z.G.S. Pal. Bull.* No. 5, p. 74, 1917).

Soletellina biradiata (Wood, 1815). [P. 1083]

Suter has admitted this Australian form from a single specimen found by Brookes in Manukau Harbour. Mr. Brookes, in sending the shell for examination, wrote as follows: "The label is in Suter's writing; he did not consider it the above species, and asked me to allow him to send it to the British Museum. It does not agree quite well with my specimens of *S. biradiata* from Tasmania, the contour of the shell is different, and is less inflated, and the teeth are somewhat different." My own Sydney specimens show numerous differences, the nymphs being very much weaker and shorter, the teeth feebler and differently placed, the muscle scars quite different in size and shape, and the pallial area smaller and differently inclined. The specimen evidently cannot bear the name *biradiata* (which should therefore disappear from New Zealand lists), but what it really is remains doubtful at present. It has the appearance of an abnormality, and may be an extra-solid distorted overgrowth of *siliqua.* On the other hand it may be a perfectly distinct new species; decision must be deferred until further similar specimens are found.

Genus **Solecurtus** Blainville, 1824.

I have added this to the fauna by describing three Tertiary species, *bensoni, evolutus* and *chattonensis (Trans. N.Z. Inst.,* vol. 55, p. 472, 1924). The reference to the generic name is *Dict. Sci. Nat. (Levrault)* vol. 32, p. 351, and the type *(vide* Iredale, *Proc. Mal. Soc.,* vol. 11, p. 306, 1915), *Solen strigillatus* L.

Corbula gibba (Olivi, 1792). [P. 1008]

This European species can be dismissed without hesitation. Suter wrote in connection with it, "The peculiarity of distribution it shares with several other bivalves—viz., *Arca reticulata, Lima lima, Cardita calyculata, Venericardia corbis, Thyasira flexuosa,* etc. As has been shown, comparison of actual specimens does not support these records; *Arca reticulata* does not occur in New Zealand, *Lima lima* and *Cardita calyculata* have perfectly distinct Neozelanic representatives, *Venericardia corbis* has been rejected by Marwick, and, when sufficient comparative material is at hand, *Thyasira flexuosa* will probably also disappear. However, in the case of *Corbula gibba,* the record appears to be simply one of a common European shell accidentally included among endemic forms.

As regards Tertiary species, I have recorded (*Trans. N.Z. Inst.*, vol. 55, p. 499, 1924) that *C. humerosa* Hutt. is equal to and has priority over *C. canaliculata* Hutt.

Saxicava artica (Linné, 1767). [P. 1012]

It would be better to follow the example of Hedley and May with regard to this species, and use Lamarck's name *Saxicava australis* in preference to admitting one world-wide species. Hedley has enlarged the genus in the Neozelanic region by recording *Saxicava antarctica* Phil. from Macquarie Island (1916, p. 33), and I know of still another species representing the aberrant Australian *S. subalata* Gat. & Gab.

Genus **Panopea** Ménard, 1807. [P. 1012]

The correct spelling is *Panope,* as used by Hedley, May, and others.

Dr. Marwick writes me that as regards the Tertiary forms, he would recognize three species as follows: *zelandica* Q. & G., Recent and Wanganuian in occurrence, with large shell, length generally a little under twice the height, irregularly folded and waved; *worthingtoni* Hutton, Oamaruian in occurrence, length over twice the height, with regular concentric folds, 6-7 per centimetre; and *orbita* Hutton, Oamaruian in occurrence, length much less than twice the height, with regular concentric folds, 3-5 per centimetre. Woods (1917) has admitted three further species to the Upper Cretaceous fauna, *awaterensis* Woods, *malvernensis* Woods, and *clausa* Wilckens. Marshall has given figures of *worthingtoni* (*Trans. N.Z. Inst.*, vol. 49, Pl. 33, f. 4) and *orbita* (*l.c.*, Pl. 37, f. 50), but his usage of the specific names should be reversed. Marwick (*Rep. Austr. Assoc. Adv. Sci.*, vol. 16, p. 320, 1924) has denied the occurrence of *orbita* in Australia, and his reproduction of Tate's figure of a supposed *orbita* fully supports this contention. As specimens I have lately seen from the Australian Tertiaries are quite constantly like Tate's figure and widely different from any New Zealand form, I finally dispose of this bad record by giving the name *Panope ralphi* n. sp. to the shell originally figured by Tate (*Trans. Roy. Soc. S.A.*, vol. 9, Pl. 18, f. 3, 1887); this specimen was from the River Murray cliffs. It is more nearly allied to the Table Cape *Panopeagnewi* (T.-W.) than to *orbita* Hutton.

Teredo bruguieri Delle Chiaje, 1828. [P. 1019]

Suter rejected *Teredo norvegica* Spengler, 1792 as "not binomial," but this erroneous conclusion, through non-access to the literature itself, has been pointed out by Calman (*Proc. Zool. Soc. Lond.*, 1920, p. 394) and Spengler's name should come into use.

Iredale has noted (1924, p. 214) that the genus *Bankia* Gray, 1842 should be used to cover the second species erroneously called *T. saulii* Wright, the correct specific name being *australis* Calman, 1920 (*loc. cit.*, p. 397), described from Brisbane, the syntype being from Auckland.

Genus **Thracia** Blainville, 1824. [P. 1023]

The Australasian species previously referred to *Thracia* appear to differ appreciably from the European type, and as the status of

Thracia itself is in doubt, a change seems necessary. Iredale has shown that two series have been confused in Australia, one showing an external ligament, the other without this feature. For the latter, *Thraciopsis* was available, and for the former *Eximiothracia* was introduced (Iredale, 1924, p. 199). The two Recent Neozelanic species, and also the Tertiary forms *vegrandis* M. & M. (*Trans. N.Z. Inst.*, vol. 51, p. 258, 1919) and *magna* M. & M. (*l.c.*, vol. 53, p. 77, 1921) and the Cretaceous *haasti* and "*Thracia* sp." Woods (1917, pp. 34, 17) seem referable to the last named.

Genus **Myodora** Gray, 1840. [P. 1028]

Dealing with species of *Myadora* (the earliest spelling), Iredale noted the restricted geographical range of the species (1924, p. 200) and one may therefore advise the rejection of several of the names included by Suter. Captain Bolton's specimen of "*brevis*" is probably the immature shell of some other species, while C. Traill's Stewart Island records of Sydney shells are of course all wrong. Traill apparently received a collection of common Sydney forms, and these were presented (probably inadvertently) to the British Museum, and are there all labelled "Stewart Island," though obviously not from that locality (information from T. Iredale). Through ignorance of the Neozelanic fauna, some of these have been recorded as from Stewart Island, as in the case of the next species, *Myadora crassa* Stutchbury, which must certainly be rejected. Suter notes, "I have not seen this species," but it is not a very rare Sydney shell.

Myadora pandoriformis (Stutchbury, 1835), the commonest Sydney species, also depends in the first instance on Traill's Stewart Island record. Misled by this, Suter has recorded the species from Port Pegasus, Stewart Island, and Iredale included it from Banks Peninsula. The name must be rejected, the records probably referring to one of the other described species, such as *M. antipoda* Smith.

Myadora rotundata Sowerby, 1875, was erroneously described from New Zealand; the type in the British Museum proves to be *tasmanica* Ten.-Woods, a Tasmanian species, so that the name must be expunged from New Zealand lists.

Chamostrea albida (Lamarck, 1819). [P. 1033]

Iredale in his "Commentary" showed that *Cleidothaerus* must be used as the generic name in place of *Chamostrea*, but did not deal with the forms confused under the above name. Collecting at Sydney, he tells me he observed that the local form, named *C. chamoides* by Stutchbury, disagreed slightly with the South Tasmanian form, the typical *C. albida* of Lamarck. While considering the advisability of separating these, he noted that the Neozelanic form was obviously a distinct species, and I had independently arrived at the same conclusion. I therefore now describe it as:—

Cleidothaerus maorianus n. sp. (Figs. 125, 126).

Shell differing from *C. chamoides* in being less compressed, i.e., the valve is shallower and muscle-scars further apart, the pallial line in the New Zealand shell being thus much longer. It has also a distinct indication of a sinus, more evident in the flat valve, the pallial line being indented and broken up into several separate scars at the

posterior muscle-scar; in the right valve the pallial line is sharply submedially angled, the anterior portion being horizontal, the posterior sloping steeply straight up to meet the muscle-scar. These features are not seen in Australian shells. Muscle-scars of left valve subparallel, not markedly divergent as in *chamoides*. Anterior end of shell much less (often not) pointed; erect portion of shell considerably higher.

Diameter (ant.-post), 63 mm.; (dorso-vent.), 70 mm.; width of attachment (right valve), 45 mm.; height of erect portion, 55 mm.

Locality.—Kawhia Harbour.

Sepia apama Gray, 1849. [P. 1058]

This was described from Southern Australia, and Iredale, by intensive collecting in the Sydney district, has proved that these animals are very local, so that the Neozelanic species may be quite different. The good description and figures given by Suter are copied without alteration from McCoy's account of Victorian specimens, the typical *S. apama.*

Iredale has lately published in the *Rec. Austr. Mus.* a monograph of the Peronian forms, but this has not yet been seen. Species are quite numerous round the Australian coasts, and individuals often extremely abundant, but no small species is yet known from New Zealand; their absence here is very striking to anyone fresh from the Sydney beaches.

In this essay I have proposed the following new generic and specific names:—

Zelorica n. gen. for *Lorica haurakiensis* Mestayer.
Nacella macquariensis n. sp. for "*Nacella delesserti*" Hedley.
Schismope lyallensis n. sp. for "*Schismope atkinsoni*" Suter.
Schismope laqueus n. sp. for "*Schismope beddomei*" Suter.
Schismope iota n. sp.
Sinezona n. gen. for *Schismope brevis* Hedley.
Monodilepas n. gen. for *Lucapina monilifera* Hutton.
Tugali colvillensis n. sp.
Thoristella (chathamensis) benthicola n. subsp.
Thoristella [chathamensis] fossilis n. subsp.
Paraclanculus n. gen. for *Paraclanculus peccatus* n. sp.
Zediloma n. gen. for *Z. digna* n. sp.
Zediloma digna n. sp. for "*Monodonta nigerrima*" Suter.
Zediloma arida n. sp. for "*Monodonta coracina*" Suter.
Fractarmilla n. subgen. for *Labio corrosa* A. Ad.
Cavodiloma n. gen. for *Trochocochlea excavata* Ad. & Ang.
Anisodiloma n. gen. for *Trochus lugubris* Gmelin.
Anisodiloma lugubris lenior n. subsp.
Micrelenchus n. gen. for *Trochus sanguineus* Gray.
Plumbelenchus n. gen. for *Trochus capillaceus* Phil.
Antisolarium n. gen. for *Solarium egenum* Gould.
Zeminolia n. gen. for *Minolia plicatula* M. & S.
Zetela n. gen. for *Minolia textilis* M. & S.
Conominolia n. gen. for *Heliacus conicus* Marshall.

Venustas n. gen. for ***Trochus tigris*** Martyn.
Venustas punctulata urbanior n. subsp.
Mucrinops n. subgen. for ***Zizyphinus spectabilis*** A. Ad.
Munditia n. gen. for ***Liotina tryphenensis*** Powell.
Liotella indigens n. sp. for "***Liotella incerta***" Mestayer.
Brookula prognata n. sp. for "***Brookula*** sp." Mestayer.
Lissotesta errata n. sp. for "***Lissospira micra***" Suter.
Incilaster n. gen. for ***Turbo marshalli*** Thomson.
Opella n. gen. for *Astrea subfimbriata* Suter.
Pellax n. gen. for *Phasianella huttoni* Pilsbry.
Zethalia nom. nov. for *Éthaliopsis* Cossmann.
Notocrater n. gen. for *Cocculina craticulata* Suter.
Tectisumen n. gen. for *Cocculina clypidellaeformis* Suter.
Tectisumen mayi nom. nov. for *Cocculina clypidellaeformis* May, not of Suter.
Melarhaphe zelandiae n. sp. for "*Litorina mauritiana*" Suter.
Macquariella n. subgen. for *Paludestrina hamiltoni* Smith.
Zelaxitas n. gen. for *Laevilitorina cystòphora* Finlay.
Zeradina n. gen. for *Fossarus ovatus* Odhner.
Radinista n. subgen. for *Couthouyia concinna* Hedley.
Nilsia n. gen. for *Fossarus conicus* Odhner.
Scrupus n. gen. for *Fossarus hyalinus* Odhner.
Nannoscrobs n. gen. for *Amphithalamus hedleyi* Suter.
Merelina plaga n. sp.
Rissoina anguina n. sp. for "*Rissoina hanleyi*" Suter, *partim.*
Zerotula n. gen. for *Discohelix hedleyi* Mestayer.
Zemelanopsis n. gen. for *Melanopsis trifasciata* Gray.
Pakaurangia n. subgen. for *Melanopsis waitaraensis* Marwick.
Zeacumantus n. gen. for *Cerithidea subcarinata* Sow.
Zebittium n. gen. for *Bittium exile* Hutton.
Specula n. gen. for *Cerithiopsis styliformis* Suter.
Mendax n. subgen. for *Cerithiopsis trizonalis* Odhner.
Socienna n. subgen. for *Cerithiopsis apicicostata* May.
Alipta n. gen. for *Cerithiopsis crenistria* Suter.
Zaclys n. gen for *Cerithiopsis sarissa* Murdoch.
Miopila n. subgen. for *Cerithiella fidicula* Suter.
Notoseila n. gen. for *Cerithium terebelloides* Hutton.
Hebeseila n. gen. for *Seila bulbosa* Suter.
Taxonia n. gen. for *Ataxocerithium suteri* Marwick.
Zefallacia n. gen. for *Fastigiella australis* Suter.
Notosinister n. gen. for *Triphora fascelina* Suter.
Teretriphora n. subgen. for *Triphora huttoni* Suter.
Cautor n. subgen. for *Triphora lutea* Suter.
Novastoa n. gen. for *Siphonium lamellosum* Hutton.
Lilax n. gen. for *Stephopoma nucleogranosum* Verco.
Spirocolpus n. gen. for *Turritella waihaoensis* Marwick.
Zeacolpus n. gen. for *Turritella vittata* Hutton.
Stiracolpus n. gen. for *Turritella symmetrica* Hutton.
Maoricolpus n. gen. for *Turritella rosea* Q. & G.
Brookesena n. gen. for *Mathilda neozelanica* Suter.
Callusaria n. subgen. for *Struthiolaria callosa* Marwick.
Zegalerus n. gen. for *Calyptraea tenuis* Gray.

Zegalerus crater nom. nov. for *Trochita alta* Hutton.
Maoricrypta n. gen. for ***Crepidula costata*** Sow.
Zeacrypta n. subgen. for *Calyptraea monoxyla* Lesson.
Trichosirius n. gen. for *Trichotropis inornatus* Hutton.
Zelippistes n. gen. for *Separatista benhami* Suter.
Triviella memorata n. sp. for "*Trivia australis*" Suter.
Charonia capax n. sp. for "*Septa rubicunda*" Suter.
Charonia capax euclioides n. subsp. for "*Charonia lampas euclia*" Finlay.
Gondwanula n. gen. for *Ranella tumida* Dunker.
Fusitriton laudandus n. sp. for "*Priene retiolum*" Finlay.
Mayena zelandica n. sp. for "*Argobuccinum australasia*" Suter.
Murdochella n. gen. for *Scala laevifoliata* M. & S.
Murdochella alacer n. sp.
Conjectura n. gen. for *Crossea glabella* Murdoch.
Crosseola errata n. sp. for "*Crossea cancellata*" Suter.
Dolicrossea vesca n. sp. for "*Crossea labiata*" Suter.
Powellia n. gen. for *P. lactea* n. sp.
Powellia comes n. sp.
Powellia paupereques n. sp.
Syrnola menda n. sp. for "*Syrnola pulchra*" Suter.
Coluzea n. gen. for *Fusus spiralis* A. Ad.
Mitra maoria n. sp. for "*Mitra carbonaria*" Suter.
Diplomitra n. gen. for *Cymbiola nitens* Marshall.
Waimatea n. gen for *Mitra inconspicua* Hutton.
Austromitra n. gen. for *Columbella rubiginosa* Hutton.
Austromitra rubiradix n. sp. for "*Vexillum planatum*" Suter.
Proximitra n. gen. for *Vexillum rutidolomum* Suter.
Egestas n. gen. for *Vexillum waitei* Suter.
Verconella (dilatata) rex n. subsp. for "*Megalatractus maximus*" Suter.
Marshallena n. gen. for *Belophos incertus* Marshall.
Glaphyrina n. gen. for *Fusus vulpicolor* Sow.
Glaphyrina [*vulpicolor*] *progenitor* n. subsp.
Aeneator n. gen. for *Verconella marshalli* Murdoch.
Evarnula n. subgen. for *Cominella striata* Hutton.
Buccinulum sufflatum n. sp. for "*Euthria striata*" Suter.
Zephos otagoensis n. sp. for "*Phos tenuicostatus*" Suter.
Zeapollia n. gen. for *Tritonidea acuticingulata* Suter.
Nassarius aoteanus n. sp. for "*Alectrion fasciata*" Suter.
Zeatrophon n. gen. for *Fusus ambiguus* Phil.
Xymenella n. gen. for *Trophon pusillus* Suter.
Paratrophon n. gen. for *Polytropa cheesemani* Hutton.
Axymene n. gen. for *Axymene turbator* n. sp.
Axymene turbator n. sp. for "*Trophon aucklandicus*" Suter.
Lenitrophon n. subgen. for *Trophon convexus* Suter.
Comptella n. gen. for *Trophon curtus* Murdoch.
Terefundus n. gen. for *Trophon crispulatus* Suter.
Minortrophon n. subgen. for *Daphnella crassilirata* Suter.
Zeadmete n. gen. for *Cancellaria trailli* Hutton.
Paxula n. gen. for *Columbella paxillus* Murdoch.

Paxula murdochi n. sp. for "*Columbella huttoni*" Murdoch.
Liratilia n. gen. for *Daphnella conquisita* Suter.
Zemitrella n. gen. for *Lachesis sulcata* Hutton.
Macrozafra n. gen. for *Clathurella subabnormis* Suter.
Antizafra n. gen. for *Columbella pisaniopsis* Hutton.
Palomelon n. subgen. for *Cymbiola lutea* Watson.
Pinguispira n. subgen. for *Ancilla (Baryspira) opima* Marwick.
Rhizorus nesentus n. sp. for "*Volvulella reflexa*" Suter.
Cylichnina opima n. sp. for "*Cylichnella pygmaea*" Suter.
Dolicheolis n. gen. for *Eolidia longicauda* Q. & G.
Benhamina n. gen. for *Siphonaria obliquata* Sow.
Cadulus teliger n. sp. for "*Cadulus spretus*" Suter.
Cosa n. gen. for *Hochstetteria costata* Bernard.
Zelithophaga n. gen. for *Lithodomus truncatus* Gray.
Notovola n. gen. for *Pecten novae-zelandiae* Reeve.
Cyclochlamys n. gen. for *Pecten transenna* Suter.
Cyclochlamys secundus n. sp. for "*Pecten* aff. *transenna*" Mestayer.
Limatula maoria n. sp. for "*Lima bullata*" Suter.
Gaimardia aucklandica n. sp. for "*Modiolarca tasmanica*" Suter.
Gaimardia forsteriana n. sp.
Kidderia hamiltoni n. sp. for *Kidderia pusilla* Hedley, not *Mytilus pusillus* Gould, nor Macgillivray.
Costokidderia n. gen. for *Kidderia costata* Odhner.
Costokidderia pedica n. sp.
Costokidderia lyallensis n. sp.
Cuna laqueus n. sp. for "*Cuna delta*" Suter.
Cardita aoteana n. sp. for "*Cardita calyculata*" Suter.
Cardita brookesi n. sp.
Pteromyrtea n. subgen. for *Cyclina dispar* Hutton.
Parvithracia n. gen. for *Montacuta triquetra* Suter.
Zemysia n. gen. for *Lucina zelandica* Gray.
Zemysina n. subgen. for *Z. globus* n. sp.
Zemysia (Zemysina) globus n. sp. for "*Diplodonta globularis*" Suter.
Zemysia (Zemysina) striatula n. sp. for "*Diplodonta striata*" Suter.
Arthritica n. gen. for *Kellia bifurca* Webster.
Notolepton n. gen. for *Kellia antipoda* Filhol.
Zemyllita n. gen. for *Pythina stowei* Hutton.
Myllitella n. gen. for *M. vivens* n. sp.
Rochefortula n. gen. for *Rochefortia reniformis* Suter.
Scintillona n. gen. for *Spaniorinus zelandicus* Odhner.
Maoritellina n. gen. for *Tellina charlottae* Smith.
Macomona n. gen. for *Tellina liliana* Iredale.
Zearcopagia n. gen. for *Tellina disculus* Desh.
Amphidesma forsteriana n. sp.
Dosinula n. gen. for *Dosina zelandica* Gray.
Austrovenus n. gen. for *Venus stutchburyi* Gray.
Irona n. gen. for *Venerupis reflexa* Gray.
Paphirus n. gen. for *Venus largillierti* Phil.
Panope ralphi n. sp. for *Panopea orbita* Tate, not Hutton.
Cleidothaerus maorianus n. sp. for "*Chamostrea albida*" Suter.

LIST OF REFERENCES CITED.

(The following list of references is believed to include titles of practically all articles written on or referring to New Zealand Mollusca, Tertiary and Recent, since the publication of Suter's "Manual of the New Zealand Mollusca," in 1913, as well as a few important works prior to that date. All the works mentioned have been consulted in drawing up the present paper.)

ALLAN, R. S., 1926. Fossil Mollusca from the Waihao Greensands. *Trans. N.Z. Inst.*, vol. 56, pp. 338–346.

ASHBY, E., 1925. Monograph of Australian Fossil Polyplacophora (Chitons). *Proc. Roy. Soc. Vict.*, vol. 37 (N.S.), pt. 2, pp. 170–205.

—— 1926 A. The Regional Distribution of Australian Chitons (Polyplacophora). *Rep. Austr. Assoc. Adv. Sci.*, vol. 17, pp. 366–393.

—— 1926 B. The Acanthoid Chitons of New Zealand, with Descriptions and Figures, including Several New Species. *Proc. Mal. Soc.* (Lond.), vol. 17, pt. 1, pp. 5–35.

BAKER, H. B., 1923. Notes on the Radula of the Neritidae, *Proc. Acad. Nat. Sci. Philad.*, vol. 75, pp. 117–178.

BARTRUM, J. A., 1919. New Fossil Mollusca. *Trans. N.Z. Inst.*, vol. 51, pp. 96–100.

BATHER, F. A., 1920. Fossils and Life (Presidential Address, Geological Section), *Rep. Brit. Assoc. Adv. Sci. for 1920*, pp. 61–86.

BENSON, W. N., 1922. Recent Advances in New Zealand Geology (Presidential Address, Section C), *Rep. Austr. Assoc. Adv. Sci.*, vol. 15, pp. 45-133.

—— 1923. Palaeozoic and Mesozoic Seas in Australasia, *Trans. N.Z. Inst.*, vol. 54, pp. 1-62.

—— 1924. The Structural Features of the Margin of Australasia, *Trans. N.Z. Inst.*, vol. 55, pp. 99-137.

BROOKES, A. E., 1924. Descriptions of Two New Species of Gastropod Shells. *Trans. N.Z. Inst.*, vol. 55, pp. 153–154.

—— 1926. New Species of Recent Mollusca. *Trans. N.Z. Inst.*, vol. 56, pp. 583–587.

BUCKNILL, C. E. R., 1924 A. *Sea Shells of New Zealand.* 123 pp.; Auckland, Whitcombe and Tombs.

—— 1924 B. On *Turbonilla powelli*, nov. spec. *Proc. Mal. Soc.* (*Lond.*) vol. 16, pt. 3, p. 122.

CHAPMAN, F., and GABRIEL, C. J., 1923. A Revision and Description of the Australian Tertiary Patellidae, Patelloididae, Cocculinidae, and Fissurellidae. *Proc. Roy. Soc. Vict.*, vol. 36 (N.S.), pp. 22–40.

CHAPMAN, F., and SINGLETON, F. A., 1925 A. A Revision of the Cainozoic Species of *Glycimeris* in Southern Australia. *Proc. Roy. Soc. Vict.*, vol. 37 (N.S.), pt. 1, pp. 18–60.

———— 1925 B. The Tertiary Deposits of Australia. *Proc. Pan-Pac. Sci. Cong.* (*Australia*) *1923*, vol. 1, pp. 985–1024.

CLARKE, E. de C., 1905. The Fossils of the Waitemata and Papakura Series. *Trans. N.Z. Inst.*, vol. 37, pp. 413–420.

COCKAYNE, L., 1919. *New Zealand Plants and their Story.* (2nd Ed.).

COSSMANN, M., 1895–1921. *Essais de Paléoconchologie Comparée*, vols. 1–12. (See note in Finlay, 1927).

COSSMANN, M., 1897–1925. *Revue Critique de Paléozoologie*, vols. 1–29 (See note in Finlay, 1927).

COTTON, C. A., 1916. The Structure and Later Geological History of New Zealand, *Geol. Mag.*, Dec. 6, vol. 3, pp. 243-49, 314-20.

—— 1918. The Outline of New Zealand, *Geogr. Rev.*, vol. 6, pp. 320-40.

DENNANT, J., and KITSON, A. E., 1903. Catalogue of the Described Species of Fossils in the Cainozoic Fauna of Victoria, South Australia, and Tasmania. *Rec. Geol. Surv. Vict.*, vol. 1, pt. 2, pp. 89–147.

FINLAY, H. J., 1923. Some Remarks on New Zealand Calliostomidae, with Descriptions of New Tertiary Species, *Trans. N.Z. Inst.*, vol. 54, pp. 99-105.

—— 1924 A. New shells from New Zealand Tertiary Beds, *Trans. N.Z. Inst.*, vol. 55, pp. 450-479.

—— 1924 B. New Zealand Tertiary Rissoids. *Ibid.*, pp. 480–490.

—— 1924 C. The Molluscan Fauna of Target Gully. *Ibid.*, pp. 494–516.

—— 1924 D. Additions to the Recent Molluscan Fauna of New Zealand. *Ibid.*, pp. 517- 526.

—— 1924 E. The Family Liotiidae, Iredale, in the New Zealand Tertiary: Part 1—The Genus *Brookula.* Ibid., pp. 526–531.

—— 1924 F. Some necessary changes in Names of New Zealand Mollusca. *Proc. Mal. Soc. (Lond.)*, vol. 16, pt. 2, pp. 99-107.

—— 1924 G. List of Recorded Relationships between Australian and New Zealand Mollusca, *Rep. Austr. Assoc. Adv. Sci.*, vol. 16, pp. 332-343.

—— 1925. Some Modern Conceptions Applied to the Study of the Cainozoic Mollusca of New Zealand. *Verbeek Mem. Birthday Vol.*, pp. 161–172.

—— 1926 A. New Shells from New Zealand Tertiary Beds: Part 2. *Trans. N.Z. Inst.*, vol. 56, pp. 227–258.

—— 1926 B. On *Iredalina*, new genus: a Volute without plaits. *Proc. Mal. Soc. (Lond.)*, vol. 17, pt. 1, pp. 59–62.

—— 1927. New Specific Names for Austral Mollusca. *Trans. N.Z. Inst.*, vol. 57.

—— and McDOWALL, F. H., 1923. Fossiliferous Limestone at Dowling Bay. *Ibid.*, vol. 54, pp. 106–114.

———— 1924. Preliminary Note on the Clifden Beds. *Ibid.*, vol. 55, pp. 534–538.

HARRIS, G. F., 1897. Catalogue of Tertiary Mollusca in the Department of Geology, British Museum (Natural History), Pt. 1, The Australasian Tertiary Mollusca. 407 pp., British Muesum, London.

HAWKINS, H. L., 1920. Invertebrate Palaeontology. 226 pp., Methuen & Co.

HEDLEY, C., 1899. A Zoogeographic Scheme for the Mid-Pacific, *Proc. Linn. Soc. N.S.W.*, vol. 24, pp. 391-417.

—— 1902. Scientific Results of the Trawling Expedition of H.M.C.S. "Thetis"; Mollusca, Pt. 1, Brachiopoda and Pelecypoda. *Mem. Austr. Mus.*, No. 4, pt. 5, pp. 288–324.

—— 1903. *Idem.*, Pt. 2, Scaphopoda and Gastropoda. *Ibid.*, pt. 6, pp. 327–402.

—— 1904. On the Change of Name of *Poroleda lanceolata* Tate. *Vict. Naturalist*, vol. 21, No. 8, p. 112.

—— 1906 A. Eighteenth-Century Names that relate to New Zealand Mollusca. *N.Z. Col. Mus. Bull. 1*, pp. 48–49.

—— 1906 B. Studies on Australian Mollusca, Pt. 9. *Proc. Linn. Soc. N.S.W.*, vol. 29, pt. 4, pp. 520–546.

—— 1907. The Mollusca of Mast Head Reef, Capricorn Group, Queensland, Pt. 2. *Ibid.*, vol. 32, pt. 3, pp. 476–513.

—— 1911. Report on the Mollusca obtained by the F.I.S. "Endeavour," chiefly off Cape Wiles, South Australia, Pt. 1. *Zool. Res. "Endeavour,"* vol. 1, pt. 1, pp. 90–114.

—— 1913. Studies on Australian Mollusca, Pt. 11. *Proc. Linn. Soc. N.S.W.*, vol. 38, pt. 2, pp. 258–339.

—— 1914. Mollusca (continued). *Zool. Res. "Endeavour,"* vol. 2, pt. 2, pp. 65–74.

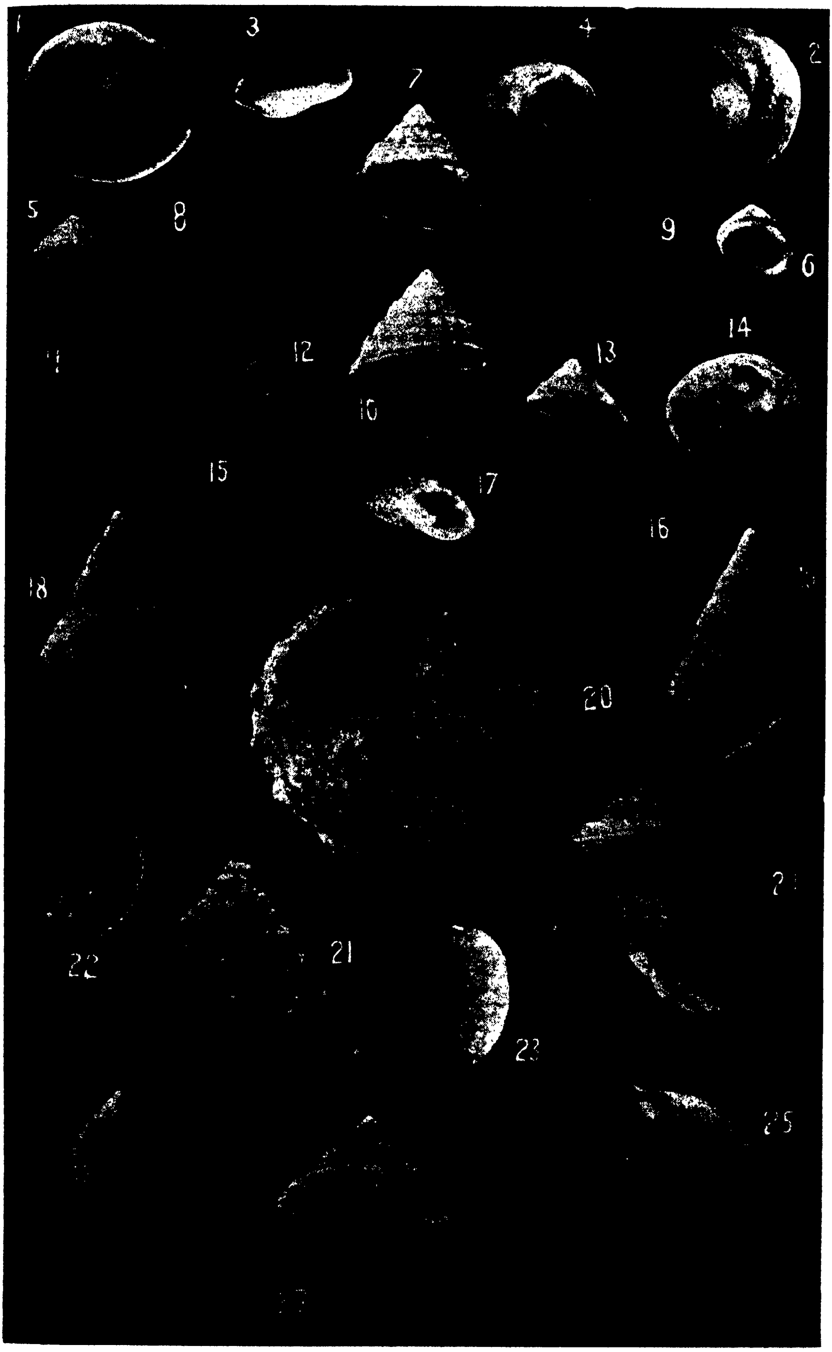
—— 1915. Studies on Australian Mollusca, Pt. 12. *Proc. Linn. Soc. N.S.W.*, vol. 39, pt. 4, pp. 695–755.

—— 1916. Mollusca, *Sci. Reps. Australasian Antarc. Exped.*, ser. C, vol. 4, pt. 1, pp. 1-80.

—— 1917. Studies on Australian Mollusca, Pt. 13. *Proc. Linn. Soc. N.S.W.*, vol. 41, pt. 4, pp. 680–719.

—— 1918 A. A Check List of the Marine Fauna of New South Wales, Pt. 1, — Mollusca. *Suppl. to Journ. Roy. Soc. N.S.W.*, vol. 51, pp. M1–M120.

—— 1918 B. Mollusca. *Proc. Roy. Geogr. Soc. Australia (S.A. Branch)*, *1916–1917*, reprint, pp. 1–21.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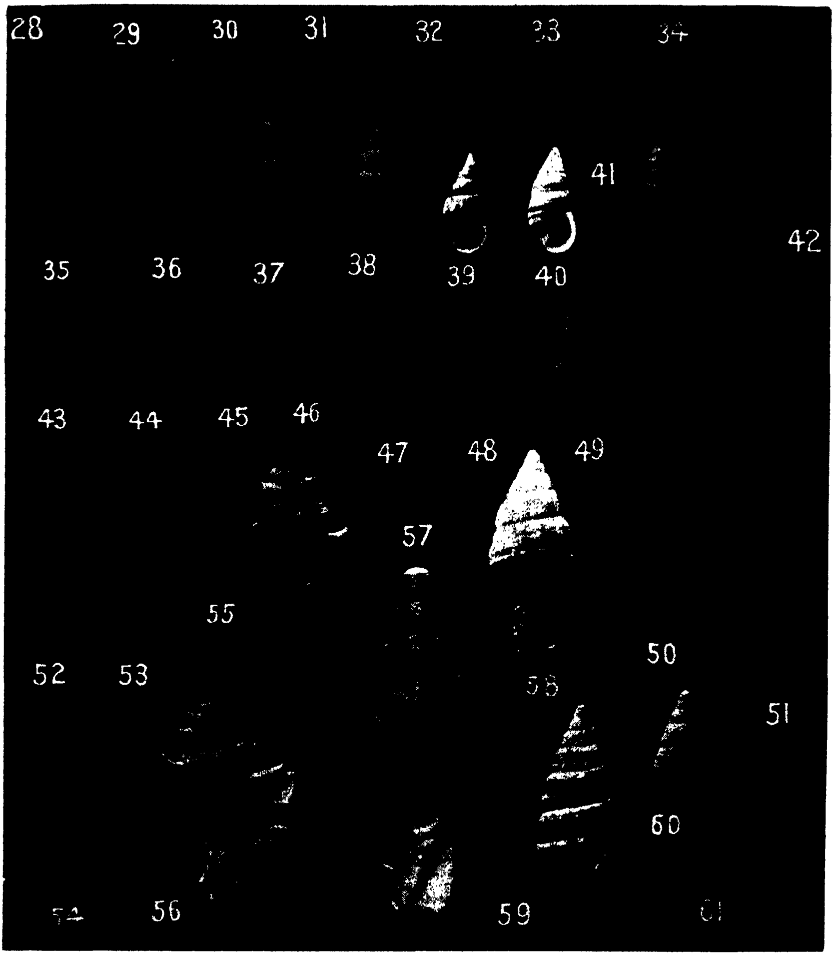
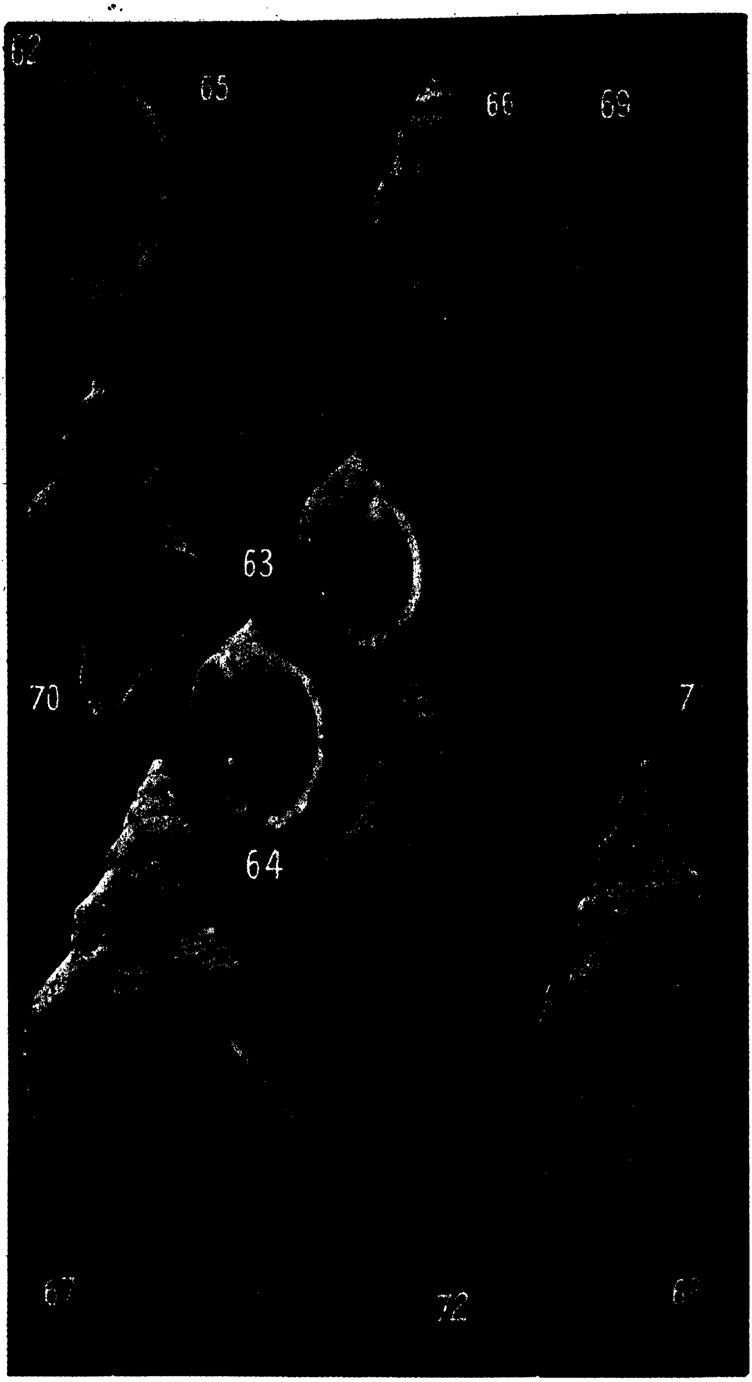
EXPLANATION OF PLATE 18.

FIGS. 1, 2.—*Sigapatella terranovae* Peile, off Cuvier Island, 40 f. × 4/3.
FIGS. 3, 4.—*Margarella decepta* (Iredale): neotype. × 1½.
FIGS. 5, 6.—*Herpetopoma larochei* Powell: topotype. × 3.
FIGS. 7–10.—*Thoristella benthicola* n.sp.: (holotype, 8). × 3.
FIGS. 11–14.—*Thoristella fossilis* n.sp.: (holotype, 13). × 3.
FIGS. 15–16.—*Thoristella dunedinensis* (Suter): topotypes. × 3.
FIG. 17.—*Paraclanculus peccatus* n.gen. et sp.: holotype. × 1½.
FIGS. 18, 19.—*Melarhaphe zelandiae* n.sp.: (holotype, 18). × 2.
FIGS. 20, 21.—*Incilaster marshalli* (Thomson): topotypes. × 2.
FIGS. 22, 23.—*Incilaster marshalli* (Thomson), operculum. × 2.
FIGS. 24, 25.—*Zediloma digna* n.gen. et sp.: holotype. × 5/3.
FIG. 26.—*Venustas* (*Mucrinops*) *spectabilis* (A. Ad.), off Otago Heads. × 1.
FIG. 27.—*Venustas* (*Mucrinops*) *urbanior* n.sp.: holotype. × 1.



FIGS. 28, 29.—*Lissotesta errata* n.sp.: (holotype, 29). × 6.
FIGS. 30, 31.—*Schismope laqueus* n.sp.: holotype. × 6.
FIG. 32.—*Dolicrossea vesca* n.sp.: holotype. × 6.
FIG. 33.—*Crosseola errata* n.sp.: holotype. × 6.
FIG. 34.—*Cylichnina opima* n.sp.: holotype. × 6.
FIGS. 35, 36.—*Merelina lyalliana* (Suter): topotypes. × 6.
FIGS. 37, 38.—*Merelina plaga* n.sp.: (holotype, 37). × 6.
FIGS. 39, 40.—*Rissoina anguina* n.sp.: (holotype, 39). × 3.
FIG. 41.—*Murdochella alacer* n.gen. and sp.: holotype. × 6.
FIG. 42.—*Alipta crenistria* (Suter), off Otago Heads, 60 f. × 3.
FIGS. 43, 44.—*Powellia paupereques* n.gen. and sp.: (holotype, 43). × 6.
FIGS. 45, 46.—*Powellia comes* n.sp.: (holotype, 45). × 6.
FIGS. 47, 48.—*Powellia lactea* n.sp.: (holotype, 47). × 6.
FIG. 49.—*Powellia semireticulata* (M. & S.): holotype. × 6.
FIGS. 50, 51.—*Syrnola menda* n.sp.: (holotype, 50). × 6.
FIGS. 52–54.—*Cadulus teliger* n.sp.: (holotype, 54). × 6.
FIG. 55.—*Pteronotus* (*Pterochelus*) *eos* (Hutton): topotype. × 1.
FIG. 56.—*Pteronotus* (*Poropteron*) *zelandicus* (Hutton): topotype. × 1.
FIG. 57.—*Mitra maoria* n.sp.: holotype. × 1.
FIGS. 58, 59.—*Austromitra antipodum* (Brookes): topotypes. × 3.
FIGS. 60, 61.—*Paxula murdochi* n.gen. et sp.: (holotype, 61). × 3.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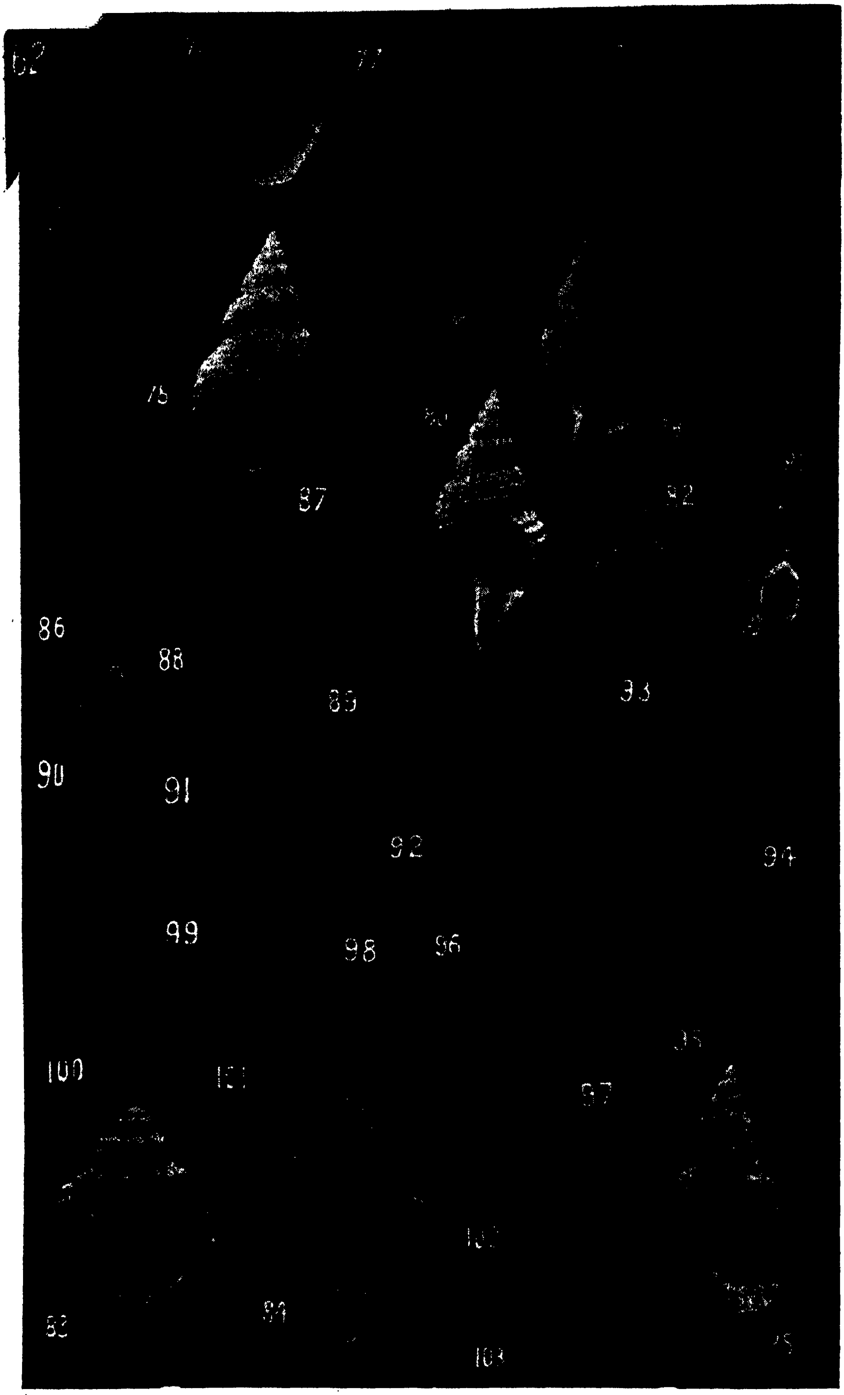
EXPLANATION OF PLATE 20.

FIGS. 62, 63.—*Phalium* n.sp. (*labiatum* auct.), Opotiki. × ¾ and 2/5.
FIG. 64.—*Phalium* n.sp. (*pyrum* auct.), 40 fath., off Whakatane. × 2/5.
FIG. 65.—*Fusitriton laudandus* n.sp.: holotype. × 3/5.
FIG. 66.—*Mayena zelandica* n.sp.: holotype. 2/5.
FIG. 67.—*Charonia capax* n.sp.: holotype. × ½.
FIG. 68.—*Charonia capax euclioides* n.subsp.: holotype. × 2/5.
FIG. 69.—*Poroleda pertubata* Iredale, Dusky Sound. × 4.
FIG. 70.—*Verconella dilatata* (Q. & G.), Castlecliff beds. × ½.
FIGS. 71, 72.—*Verconella rex* n.sp.: holotype. × 3/5.



EXPLANATION OF PLATE 21.

FIG. 73.—*Triviella memorata* n.sp.: holotype. × 4/3.

FIG. 74.—*Triviella merces* Iredale, Port Jackson. × 4/3.

FIGS. 75, 76.—*Buccinulum sufflatum* n.sp.: (holotype, 76). × 5/4.

FIG. 77.—*Buccinulum* (*Evarnula*) *fuscozonatum* (Suter), Whangaroa. × 1½.

FIGS. 78, 79.—*Buccinulum* (*Evarnula*) *striatum* (Hutton): topotypes. × 1.

FIG. 80.—*Glaphyrina vulpicolor* (Sow.), off Otago Heads, 60 f. × 1.

FIG. 81.—*Zephos otagoensis* n.sp.: holotype. × 1.

FIG. 82.—*Agnewia tritoniformis* (Blainville), Whangaroa. × 1.

FIGS. 83, 84.—*Cymatium exaratum* (Reeve), Tauranga. × 1.

FIG. 85.—*Austrotriton parkinsonianum* (Perry), Whangaroa. × 1.

FIGS. 86–89.—*Hochstetteria modiolus* (Suter): topotypes. × 6.

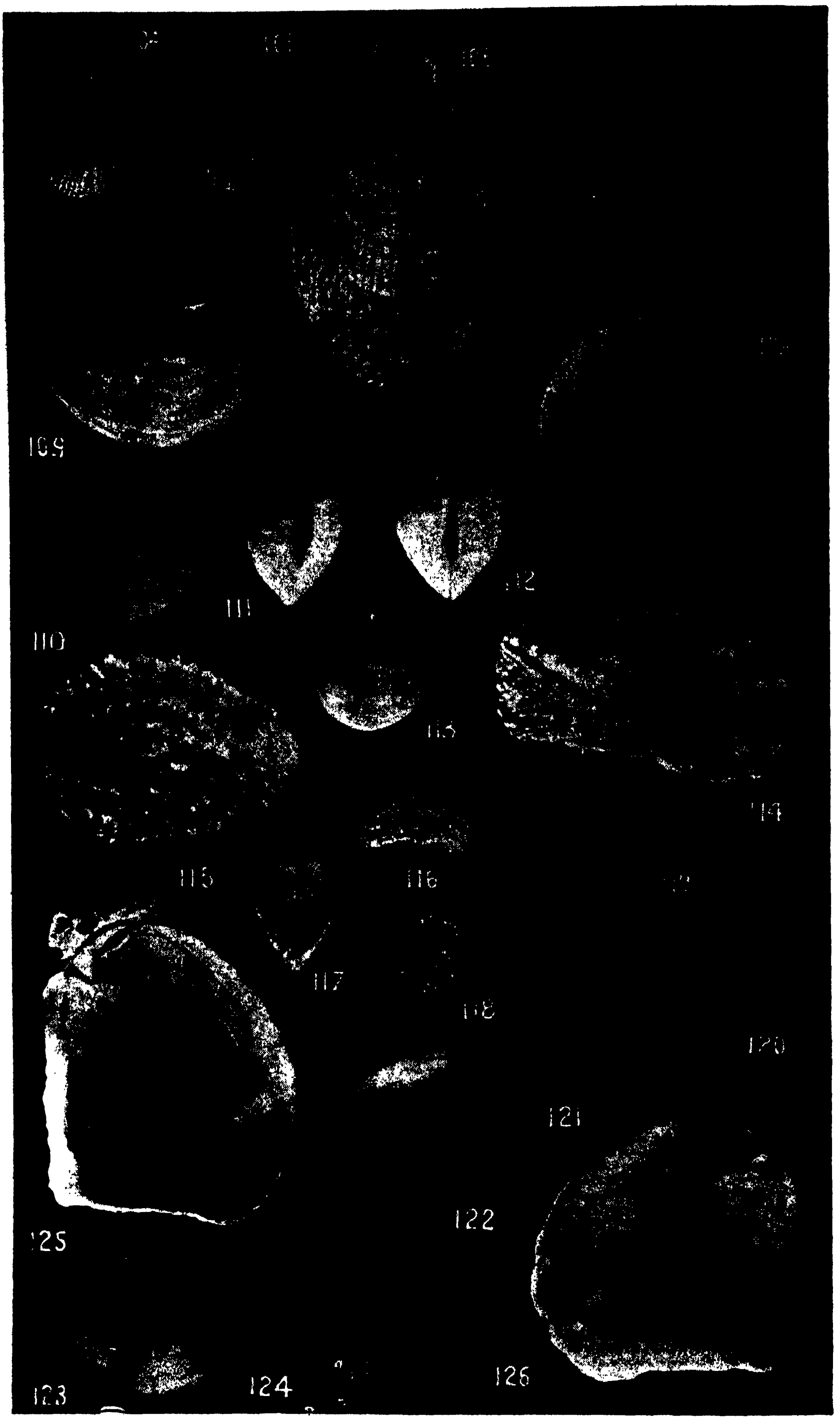
FIGS. 90–92.—*Cuna laqueus* n.sp.: (holotype, 92). × 5.

FIGS. 93–95.—*Costokidderia lyallensis* n.gen. et sp.: (holotype, 95). × 6.

FIG. 96–98.—*Costokidderia pedica* n.sp.: (holotype, 96). × 6.

FIGS. 99–01.—*Costokidderia costata* (Odhner): topotypes. × 6.

FIGS. 102, 103.—*Kidderia acrobeles* (Suter): topotypes. × 6.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EXPLANATION OF PLATE 22.

FIGS. 104–106.—*Limatula maoria* n.sp.: (holotype, 106). × 4/3.

FIGS. 107–108.—*Macomona liliana* (Iredale), Stewart Island. × 1.

FIGS. 109–111.—*Zemysia* (*Zemysina*) *globus* n.gen. et sp.: (holotype, 109). × 1¼.

FIGS. 112, 113.—*Zemysia* (*Zemysina*) *striatula* n.sp.: (holotype, 113). × 1¼.

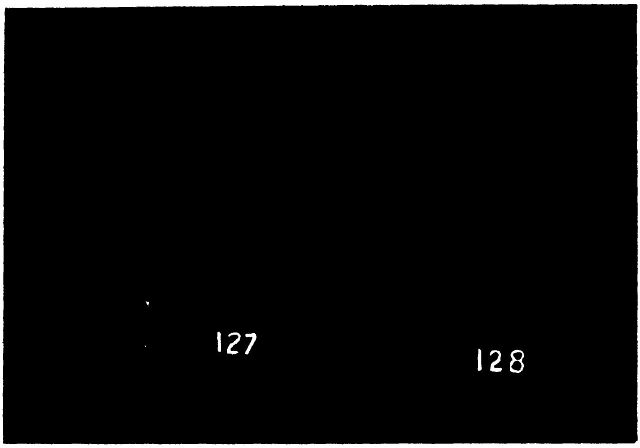
FIGS. 114, 115.—*Cardita aoteana* n.sp.: holotype. × 1⅓.

FIGS. 116–118.—*Cardita brookesi* n.sp.: (holotype, 116). × 1½.

FIGS. 119–121.—*Myllitella vivens* n.gen. et sp.: (holotype, 119). × 6.

FIGS. 122–124.—*Gaimardia aucklandica* n.sp.: (holotype, 124). × 6.

FIGS. 125–126.—*Cleidothaerus maorianus* n.sp.: holotype. × 2/3.



Axymene turbator n.gen. and sp.

HEDLEY, C., 1919 A. Notes on the Rock-oyster Fishery of Auckland. *N.Z. Journ. Sci. and Tech.*, vol. 2, no. 6, pp. 365–366.
—— 1919 B. On *Siphonalia dilatata* of Suter's Manual. *Ibid.*, vol. 3, no. 1, Nat. Hist. Note, p. 54. (See also corrections of misprints in this paper, *ibid.*, vol. 3, no. 3, p. 170, 1920, and no. 4, p. 222, 1920).
—— 1919 C. A Revised Name for a New Zealand Trochoid. *Ibid.*, vol. 3, p. 54.
—— 1919 D. *Cominella quoyi* Kiener. *Ibid.*, p. 55.
—— 1919 E. A Revision of the Australian Tun Shells. *Rec. Austr. Mus.*, vol. 12, no. 11, pp. 329–336.
—— 1922. A Revision of the Australian Turridae. *Rec. Austr. Mus.*, vol. 13, no. 6, pp. 213–359.
—— 1923. Studies on Australian Mollusca, Pt. 14. *Proc. Linn. Soc. N.S.W.*, vol. 48, pt. 3, pp. 301–316.
—— 1924 A. A Revision of the Australian Pinnidae. *Rec. Austr. Mus.*, vol. 14, no. 3, pp. 142–153.
—— 1924 B. Some Naticoids from Queensland. *Ibid.*, pp. 154–161.
—— and SUTER, H., 1910. The Genus *Cremnobates* Swainson. *Proc. Mal. Soc. (Lond.)*, vol. 9, pt. 3, pp. 151–152.
HUTTON, F. W., 1873 A. Catalogue of the Marine Mollusca of New Zealand, with descriptions of the species. 116 pp.; Govt. Printer, Wellington.
—— 1873 B. Catalogue of the Tertiary Mollusca and Echinodermata of New Zealand in the collection of the Colonial Museum. 48 pp.; Govt. Printer, Wellington.
—— 1880. Manual of the New Zealand Mollusca. 224 pp.; James Hughes, Wellington.
—— 1905. Three New Tertiary Shells. *Trans. N.Z. Inst.*, vol. 37, pp. 472–474.
IREDALE, T., 1908 A. Notes on some New Zealand Marine Mollusca. *Trans. N.Z. Inst.*, vol. 40, pp. 373–387.
—— 1908 B. A Preliminary List of the Marine Mollusca of Banks Peninsula, New Zealand. *Ibid.*, pp. 387–403.
—— 1911 A. On Some Misapplied Molluscan Generic Names. *Proc. Mal. Soc. (Lond.)*, vol. 9, pt. 4, pp. 253–263.
—— 1911 B. Value of the Gastropod Apex in Classification. *Ibid.*, pt. 5, pp. 319–323.
—— 1912. New Generic Names and New Species of Marine Mollusca. *Ibid.*, vol. 10, pt. 3, pp. 217–228.
—— 1914. Invalid Molluscan Generic Names. *Ibid.*, vol. 11, pt. 3, pp. 170–178.
——1915 A. Some More Misused Molluscan Generic Names. *Ibid.*, pt. 5, pp. 292–306.
—— 1915 B. A Commentary on Suter's *Manual of the New Zealand Mollusca. Trans. N.Z. Inst.*, vol. 47, pp. 417–497.
—— 1917. More Molluscan Name-changes. *Proc. Mal. Soc. (Lond.)*, vol. 12, pt. 6, pp. 322-330.
—— 1918. Molluscan Nomenclatural Problems and Solutions—No. 1. *Ibid.*, vol. 13, pts. 1 and 2, pp. 28–40.
—— 1921. *Idem*—No. 2. *Ibid.*, vol. 14, pts. 5 and 6, pp. 198–208.
—— 1922. The Nomination of "Recent" Fossil Mollusca. *Ibid.*, vol. 15, pt. 1, pp. 37–38.
—— 1924. Results from Roy Bell's Molluscan Collections, *Proc. Linn. Soc. N.S.W.*, vol. 49, pt. 3, pp. 179–278.
—— 1925. Mollusca from the Continental Shelf of Eastern Australia. *Rec. Austr. Mus., vol.* 14, no. 4, pp. 243–270.
—— and O'DONOGHUE, C., 1923. List of British Nudibranchiate Mollusca. *Proc. Mal. Soc. (Lond.)*, vol. 15, pt. 4, pp. 195–200, and pt. 5, pp. 201–233.
—— and HULL, A. F. B., 1923–1925. A Monograph of the Australian Loricates. *Austr. Zoologist*, vol. 3.
LANG, W. D., 1919. The Pelmatoporinae, an Essay on the Evolution of a Group of Cretaceous Polyzoa. *Trans. Roy. Soc. Lond.*, ser. B, vol. 209, pp. 191–228.
—— 1912. Palaeontology and Bernard's Biological Theories. *Geol. Mag.*, N.S., Dec. 5, vol. 9, pp. 550–558.

MARSHALL, P., 1916. Relations between Cretaceous and Tertiary Rocks. *Trans. N.Z. Inst.*, vol. 48, pp. 100–119.
—— 1917. The Wangaloa Beds. *Ibid.*, vol. 49, pp. 450–460.
—— 1918. The Tertiary Molluscan Fauna of Pakaurangi Point, Kaipara Harbour. *Ibid.*, vol. 50, pp. 263–278.
—— 1919. Fauna of the Hampden Beds and Classification of the Oamaru System. *Ibid.*, vol. 51, pp. 226–250.
—— 1920 A. The Hampden Beds and the New Zealand Tertiary Limestones. *Ibid.*, vol. 52, pp. 111–114.
—— 1920 B. The Tertiary Rocks near Wanganui. *Ibid.*, pp. 115–128.
—— 1923. Early Tertiary Molluscan Faunas of New Zealand. *Ibid.*, vol. 54, pp. 115–121.
—— and MURDOCH, R., 1919. Some New Fossil Species of Mollusca. *Ibid.*, vol. 51, pp. 253–258.
———— 1920. Some Tertiary Mollusca, with Descriptions of New Species. *Ibid.*, vol. 52, pp. 128–136.
———— 1921 A. *Idem. Ibid.*, vol. 53, pp. 77–86.
———— 1921 B. Tertiary Rocks near Hawera. *Ibid.*, pp. 86–96.
———— 1923. Some Tertiary Mollusca, with Descriptions of New Species. *Ibid.*, vol. 54, pp. 121–128.
MARTIN, K., 1914. Wanneer is de Indische Archipel gescheiden van de Tethys ? *Konin. Akad. van Wetenschappen te Amsterdam*, Deel 22, pp. 732–734.
—— 1917. On the Miocene Fauna of the West-Progo Mountains in Java. *Ibid.*, vol. 20, no. 6, pp. 800–804.
MARWICK, J., 1922. Fossil Pearls of New Zealand. *N.Z. Journ. Sci. and Tech.*, vol. 5, no. 4, pp. 202–203.
—— 1923. The Genus *Glycimeris* in the Tertiary of New Zealand. *Trans. N.Z. Inst.*, vol. 54, pp. 63–80.
—— 1924 A. Notes on a Molluscan Collection of Supposed Waiarekan Age. *N.Z. Journ. Sci. and Tech.*, vol. 6, nos. 5 and 6, p. 280.
—— 1924 B. An Examination of some of the Tertiary Mollusca claimed to be common to Australia and New Zealand. *Rep. Austr. Assoc. Adv. Sci.*, vol. 16, pp. 316–331.
—— 1924 C. The Struthiolariidae. *Trans. N.Z. Inst.*, vol. 55, pp. 161–190.
—— 1924 D. Palaeontological Notes on some Pliocene Mollusca from Hawke's Bay. *Ibid.*, pp. 191–201.
—— 1924 E. The Tertiary and Recent Naticidae and Naricidae of New Zealand. *Ibid.*, pp. 545–579.
—— 1924 F. *Zealeda* and *Barytellina*, new fossil Molluscan Genera from New Zealand. *Proc. Mal. Soc. (Lond.)*, vol. 16, pt. 1, pp. 25, 26.
—— 1925. The Indo-Pacific Element in the Marine Tertiary Mollusca of New Zealand. *Verbeek Mem. Birthday Vol.*, pp. 369-378.
—— 1926 A. Tertiary and Recent Volutidae of New Zealand. *Trans. N.Z. Inst.*, vol. 56, pp. 259–303.
—— 1926 B. Molluscan Fauna of the Waiarekan Stage of the Oamaru Series. *Ibid.*, pp. 307–316.
—— 1926 C. New Tertiary Mollusca from North Taranaki. *Ibid.*, pp. 317–331.
—— 1926 D. Origin of the Tertiary Mollusca of New Zealand. *N.Z. Journ. Sci. and Tech.*, vol. 8, no. 5, pp. 269-272.
MAY, W. L., 1919 A. Critical Remarks on the Table Cape Fossil Mollusca in the Johnston Collection, with Figures. *Pap. Roy. Soc. Tas.* for 1918, pp. 69–73.
—— 1919 B. A Revised Census of the Mollusca and Brachiopoda in the Table Cape Beds. *Ibid.*, pp. 101–117.
—— 1921. *A Check-List of the Mollusca of Tasmania.* 114 pp.; Govt. Printer, Hobart.
—— 1923. *Illustrated Index of Tasmanian Shells.* 100 pp.; Govt. Printer, Hobart.
MESTAYER, M. K., 1916. Preliminary List of Mollusca from Dredgings taken off the Northern Coast of New Zealand. *Trans. N.Z. Inst.*, vol. 48, pp. 122–128.
—— 1918 A. A Note on the Young Stages of *Astrea heliotropium* (Martyn). *Ibid.*, vol. 50, pp. 191–192.

MESTAYER, M. K., 1918 B. The Occasional Occurrence of Australian and South Sea Island Molluscs in New Zealand. *N.Z. Journ. Sci. and Tech.*, vol. 1, no. 2, pp. 102–104.

—— 1919. New Species of Mollusca Dredged off New Zealand, Snares, and Bounty Islands. *Trans. N.Z. Inst.*, vol. 51, pp. 130–135.

—— 1920 A. Note on a Habit of the Chiton *Cryptoconchus porosus* (Burrow). *N.Z. Journ. Sci. and Tech.*, vol. 3, no. 2, Nat. Hist. Note, p. 117.

—— 1920 B. A Note on *Pleurobranchaea novaezelandiae* Cheeseman. *Ibid.* no. 3, Nat. Hist. Note, p. 170.

—— 1920 C. Note on the Spawn-Coils of *Kerguelenia obliquata* (Sow.). *Ibid.*, p. 171.

—— 1921 A. The Occurrence of *Cylichnella arachis* (Q. & G.) in New Zealand Waters. *Ibid.*, nos. 5 and 6, Nat. Hist. Note, p. 303.

—— 1921 B. Notes on the Natural Camouflage of some Marine Mollusca. *Ibid.*, vol. 4, no. 2, p. 39.

—— 1921 C. Notes on the Habits and Uses of the Toheroa. *Ibid.*, pp. 84–85.

—— 1921 D. Notes on New Zealand Mollusca: No. 1, Descriptions of Three New Species of Polyplacophora, and of *Damoniella alpha. Trans. N.Z. Inst.*, vol. 53, pp. 176–180.

—— 1921 E. *Idem.*: No. 2. *Ibid.*, p. 180.

—— 1926. *Idem.*: No. 3. *Ibid.*, vol. 56, pp. 583–587.

MORGAN, P. G., 1922. Notes on the Geology of New Zealand. *N.Z. Journ. Sci. and Tech.*, vol. 5, no. 1, pp. 46–57.

MOSS, E. G. B., 1908. *The Beautiful Shells of New Zealand.* 46 pp.; Collins Bros. & Co., Auckland.

MURDOCH, R., 1900. New Species of Pliocene Mollusca from Wanganui, with Notes on other Species. *Trans. N.Z. Inst.*, vol. 32, pp. 216–221.

—— and FINLAY, H. J., 1923. The Occurrence of Land Mollusca in a Recent Sea-beach Deposit. *Ibid.*, vol. 54, pp. 131–133.

ODHNER N. H., 1924. New Zealand Mollusca. *Pap. Mort. Pacific Exped., 1914–1916*, No. 19, pp. 1–88.

OLIVER, W. R. B., 1915. The Mollusca of the Kermadec Islands. *Ibid.*, vol. 47, pp. 509–568.

—— 1923 A. Marine Littoral Plant and Animal Communities in New Zealand. *Ibid.*, vol. 54, pp. 496–545.

—— 1923 B. Notes on New Zealand Pelecypods. *Proc. Mal. Soc. (Lond.)*, vol. 15, pt. 4, pp. 179–188.

—— 1926. Australasian Patelloididae. *Trans. N.Z. Inst.*, vol. 56, pp. 547–582.

PARK, J., 1921. The Birth and Development of New Zealand. *Ibid.*, vol. 53, pp. 73-76.

PEILE, A. J., 1924. A new species of *Sigapatella* (*S. terranovae*). *Proc. Mal. Soc. (Lond.)*, vol. 16, pt. 1, pp. 21–23.

POWELL, A. W. B., 1921. Some North Auckland Marine Mollusca. *N.Z. Journ. Sci. and Tech.*, vol. 4, no. 4, Nat. Hist. Note, p. 204.

—— 1924 A. Notes on New Zealand Mollusca. *Ibid.*, vol. 6, nos. 5 and 6, pp. 282–286.

—— 1924 B. Description of a new subspecies of *Alcithoe arabica* Martyn, from New Zealand. *Proc. Mal. Soc. (Lond.)*, vol. 16, pt. 2, pp. 108–109.

—— 1924 C. On a New Species of *Epitonium*. *Trans. N.Z. Inst.*, vol. 55, p. 138.

—— 1926 A. Descriptions of Six New Species and a New Genus of Gastropod Mollusca from Northern New Zealand. *Ibid.*, vol. 56, pp. 591–596.

—— 1926 B. Descriptions of two new Gastropods from Whangaroa, New Zealand. *Proc. Mal. Soc. (Lond.)*, vol. 17, pt. 1, pp. 36–38.

—— 1926 C. Mollusca from 100 fathoms, off Lyttelton, with Descriptions of Four New Species, and also a New Pliocene Fossil. *Rec. Cant. Mus.*, vol. 3, pt. 1, pp. 43-50.

SMITH, E. A., 1915. Mollusca, pt. 1—Gastropoda Prosobranchia, Scaphopoda, and Pelecypoda. *Brit. Antarc. ("Terra Nova") Exped. 1910, Nat. Hist. Report*, Zool., vol. 2, no. 4, pp. 61–112.

SUTER, H., 1911. Two New Fossil Mollusca. *Trans. N.Z. Inst.*, vol. 43, pp. 595–596.
—— 1913 A. Manual of the New Zealand Mollusca, with (1915) Atlas of Plates. 1120 pp.; Govt. Printer, Wellington.
—— 1913 B. New Species of Tertiary Mollusca. *Trans. N.Z. Inst.*, vol. 45, pp. 294–297.
—— 1913 C. Descriptions of Two New Marine Shells from New Zealand. *Rec. Cant. Mus.*, vol. 2, pt. 1, pp. 57, 58.
—— 1914. Revision of the Tertiary Mollusca of New Zealand, Pt. 1, *N.Z. Geol. Surv. Pal. Bull. No. 2*, pp. 1–64.
—— 1915 A. *Idem.*, Pt. 2. *Ibid.*, No. 3, pp. 1–69.
—— 1915 B. Alphabetical Hand-List of New Zealand Tertiary Mollusca. 28 pp.; Govt. Printer, Wellington.
—— 1917 A. On the Origin of a New Species by Isolation. *Trans. N.Z. Inst.*, vol. 49, pp. 279–283.
—— 1917 B. Descriptions of New Tertiary Mollusca Occurring in New Zealand. *N.Z. Geol. Surv. Pal. Bull. No. 5*, pp. 1–93.
—— 1918. Alphabetical List of New Zealand Tertiary Mollusca. 32 pp.; Govt. Printer, Wellington.
—— 1919. Description of a New Species of the Family Cerithiidae. *Trans. N.Z. Inst.*, vol. 51, pp. 68, 69.
SWINNERTON, H. H., 1925. Outlines of Palaeontology. 420 pp.; Arnold and Co., London.
TATE, R., 1878. The Fossil Marginellidae of Australasia. *Trans. Phil. Soc. Adelaide for 1877–78*, pp. 90–98.
—— 1886. The Lamellibranchs of the Older Tertiary of Australia, Pt. 1. *Trans. Roy. Soc. S.A.*, vol. 8, pp. 96–158.
—— 1887 A. *Idem.*, Pt. 2. *Ibid.*, vol. 9, pp. 142–189.
—— 1887 B. The Scaphopods of the Older Tertiary of Australia. *Ibid.*, pp. 190–194.
—— 1887 C. The Pteropods of the Older Tertiary of Australia. *Ibid.*, pp. 194–196.
—— 1888. The Gastropods of the Older Tertiary of Australia, Pt. 1. *Ibid.*, vol. 10, pp. 91–176.
—— 1889. *Idem.*, Pt. 2. *Ibid.*, vol. 11, pp. 116–174.
—— 1890. *Idem.*, Pt. 3. *Ibid.*, vol. 13, pp. 185–235.
—— 1893. *Idem.*, Pt. 4. *Ibid.*, vol. 17, pt. 2, pp. 316–345.
—— 1894. Unrecorded Genera of the Older Tertiary Fauna of Australia, including diagnoses of some New Genera and Species. *Journ. Roy. Soc. N.S.W.*, vol. 27, pp. 167–197.
—— 1898 A. A Second Supplement to a Census of the Fauna of the Older Tertiary of Australia. *Ibid.*, vol. 31, pp. 381–412.
—— 1898 B. On Some Recent and Fossil Australian Species of Philobryae. *Trans. Roy. Soc. S.A.*, vol. 22, pt. 2, pp. 86–89.
—— and MAY, W. L., 1901. A Revised Census of the Marine Mollusca of Tasmania. *Proc. Linn. Soc. N.S.W.*, vol. 26, pp. 344–471.
THOMSON, J. A., 1916. On Stage Names Applicable to the Divisions of the Tertiary in New Zealand. *Trans. N.Z. Inst.*, vol. 48, pp. 28–40.
—— 1918. Brachiopoda. *Sci. Reps. Australasian Antarct. Eped.*, ser. C, vol. 4, pt. 3, pp. 51–63.
—— 1919 A. Polymorphism in the Common New Zealand Limpet, *Cellana radians* (Gmelin). *N.Z. Journ. Sci. and Tech.*, vol. 2, nos. 4 and 5, pp. 264–267.
—— 1919 B. Geological and Palaeontological Notes on the Palliser Bay District. *Ibid.*, pp. 267–268.
—— 1920. The Notocene Geology of the Middle Waipara and Weka Pass District, North Canterbury, New Zealand, *Trans. N.Z. Inst.*, vol. 52, pp. 322-415.
TILLYARD, R. J., 1924. Origin of the Australian and New Zealand Insect Faunas, *Rep. Austr. Assoc. Adv. Sci.*, vol. 16, pp. 407-13.
TOMLIN, J. R. Le B., and PEILE, A. J., 1925. Notes on the Identity of *Patella affinis* Reeve. *Proc. Mal. Soc. (Lond.)*, vol. 16, pt. 4, p. 198.
VAUGHAN, T. W., 1921. The Correlation of the Later Mesozoic and Cenozoic Formations of New Zealand, *Proc. First Pan-Pacific Scientific Conf.*, pt. 3, pp. 713-43.

VAUGHAN, T. W., 1924. Criteria and Status of Correlation and Classification of Tertiary Deposits. *Bull. Geol. Soc. America*, vol. 35, pp. 677–742.
VREDENBURG, E. W., 1910. *A Summary of the Geology of India.* (2nd Ed.).
WILCKENS, O., 1920 A. Die Kreideformation von Neuseeland. *Geol. Rundschau*, Bd. 11.
—— 1920 B. Das Neuseelandische obersenon, nebst einigen Bemerkungen über seine Bivalvenfauna. *Zentralbl. f. Min.*, 1920.
—— 1922. The Upper Cretaceous Gastropods of New Zealand. *N.Z. Geol. Surv. Pal. Bull. No. 9*, pp. 1–42.
WINCKWORTH, R., 1922. Note on the British species of *Anomia*. *Proc. Mal. Soc. (Lond.)*, vol. 15, pt. 1, pp. 32-34.
WOODRING, W. P., 1925. Miocene Mollusks from Bowden, Jamaica. Pelecypods and Scaphopods. *Carnegie Inst. of Washington*, Publication No. 366; 222 pp.
WOODS, H., 1917. The Cretaceous Faunas of the North-Eastern part of the South Island of New Zealand. *N.Z. Geol. Surv. Pal. Bull. No. 4*, pp. 1–42.
WOODWARD, B. B., 1924. Date of Publication of S. Nilsson's *Historia Molluscorum Sveciae*. *Proc. Mal. Soc. (Lond.)*, vol. 16, pt. 1, p. 23.
YOUNG, M., 1924. Note on the Spawning of *Doris wellingtonensis* Abraham. *N.Z. Journ. Sci. and Tech.*, vol. 7, no. 3, Zool. Note, p. 189.

Additions to the Recent Molluscan Fauna of New Zealand.—No. 2.

By H. J. FINLAY, M.Sc., National Research Scholar in Palaeontology.

[*Read before the Otago Institute, 8th December, 1925; received by Editor, 31st December, 1925; issued separately, 19th January, 1927.*]

Plates 24, 25.

Venustas cunninghami regifica n. subsp. (Figs. 9, 10).

1924: *Calliostoma selectum* (Chemnitz): Finlay, *Trans. N.Z. Inst.*, vol. 55, p. 518.

The southern (Forsterian) representative of the North Island (Cookian) *V. cunninghami* (Griff. & Pidg.) (see elsewhere this vol.). Altogether a larger and more handsome shell, but differing especially in the characters of periphery and base. Periphery very roundly angled, not acute as in the species; base considerably inflated and convex, the vertical distance from periphery to anterior extremity of shell, gauged at the outer lip, being three-quarters of vertical distance from periphery to suture; in the species itself the base is very depressed and almost flat, the former vertical distance being only one-fourth to one-third of the latter. Umbilical callus area relatively larger, and less hollowed, columella much longer and less excavated.

Height, 54 mm.; diameter, 62 mm.; ht. of aperture, 26 mm. (type).
Height, 59 mm.; diameter, 59 mm.; ht. of aperture, 25 mm. (most elate paratype).

Habitat.—off Otago Heads, in 30 fathoms; ten living specimens. Type in Finlay collection.

Larochea miranda n. gen. and sp. (Figs. 6, 7, 8.)

Shell auriform, extremely minute, fragile and translucent; with the facies (but not the notch) of *Scissurona* Iredale (*P.L.S.N.S.W.*, vol. 49, p. 215, 1924), the spiral striation and planorbid apex of *Sinum*, the internal shelf of *Crepidula*, the patulous, rather irregular, aperture of *Stomatia*, and the suddenly-obliquely-truncated winding columella of *Haliotis*. Shell of about three whorls, of which the apex forms perhaps one; it is smooth and vitreous, quite indefinite, flatly helicoid, only slightly raised above the surface of the body-whorl as a weak tabulation. The rest of the shell has dense spiral lineations all over; grooves or ribs are not distinguishable, the spirals being formed of alternate whitish sub-opaque bands separated by equally narrow water-coloured translucent areas: just above the upper subangulation is a more opaque spiral band, about half width of shoulder. Two extremely blunt and rounded angulations above and below periphery. Suture very indistinct. Aperture forming nearly the whole base of the shell, irregularly oval; outer lip thin and sharp, faintly convex and almost horizontal up to the first angulation, more convex and subvertical between first and second, swinging in and up past the second, suddenly twisted on joining inner lip and seeming to divide there, one half being continuous with edge of internal shelf, which also terminates there. Inner lip shining, adherent to parietal wall and base for most of its length, with a slight free edge where it joins outer lip above and a strong inward kink where it joins it below. Base narrow, rather convex, of constant width till suddenly obliquely truncated by the twisted kink at the join of the internal shelf. Interior shining, showing external sculpture plainly, generally smooth, but in some specimens studded with numerous granose pustules. Internal shelf set deep within, rather close to the shell itself, smooth and shining, with a straight but very oblique edge, the lower joint (to inner and outer lips) being much further forward than the upper (within the spire cavity, along the lower edge of the opaque shoulder band).

Length, 1.1 mm.; height, 0.5 mm.

Habitat.—dredged in 12 fathoms, Awanui Bay, North Auckland.

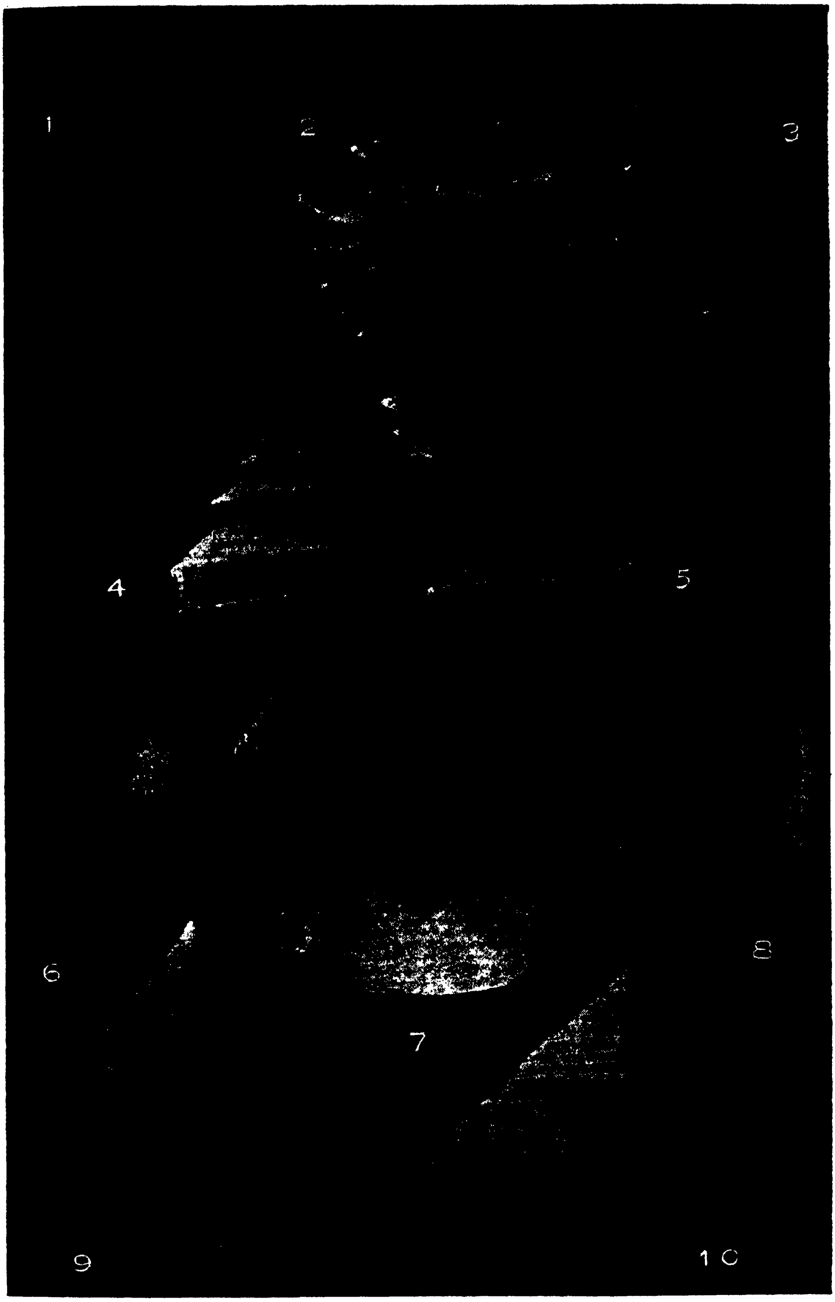
Type in Finlay collection.

The relationships of this curious form are so obscure that it would be profitless at present to discuss them. That it cannot be referred to any austral group yet known is evident, nor can I suggest any Family location with confidence. I therefore indicate it as representative of a new Family, *Larocheidae* which may be placed provisionally in the neighbourhood of Merriidae. If the umbilicus of *Merria* or *Korovania* were so exaggerated and pushed in that an internal plate resulted, something quite like *Larochea* might be formed.

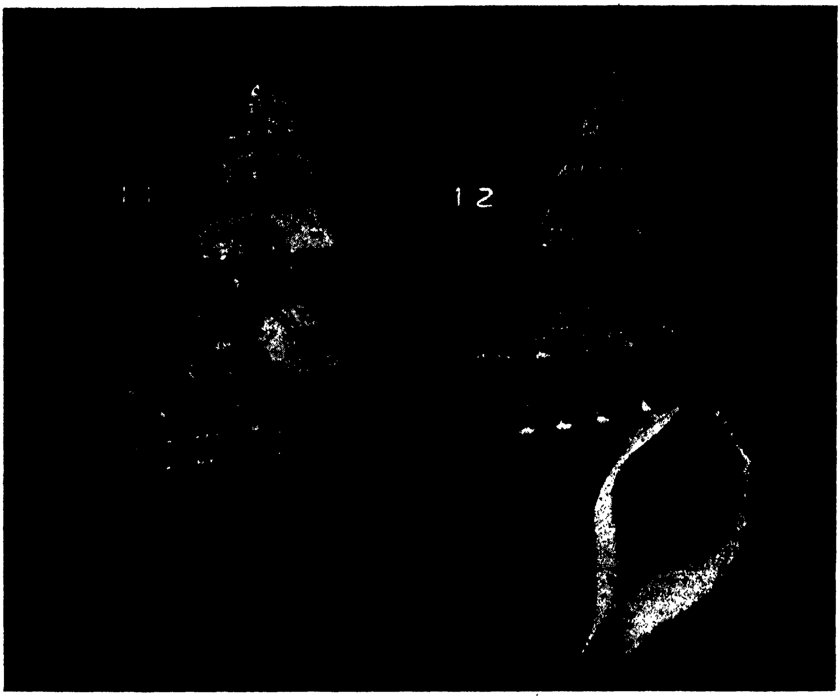
The genus is named after the discoverer of this very interesting shell, Mr. W. La Roche of Auckland, an enthusiastic collector.

Austrofusus glans agrestior n. subsp. (Figs. 1, 3, 11, 12.)

This is again the Forsterian representative of the Cookian *A. glans* (Bolten), Wellington specimens of which are here figured for



FIGS. 1, 3.—*Austrofusus glans agrestior* n. subsp.: Paratype, × 1.
FIGS. 4, 5.—*Austrofusus glans* (Bolten): Wellington specimen, × 1.
FIG. 2.—*Murexsul cuvierensis* n. sp.: Holotype, × 4.
FIGS. 6, 7, 8.—*Larochea miranda* n. gen. and sp.: Holotype, × 40.
FIG. 9.—*Venustas cunninghami regifica* n. subsp.: Holotype, × 1.
FIG. 10.—*Venustas cunninghami regifica* n. subsp.: Paratype, × 1.



FIGS. 11, 12.—*Austrofusus glans agrestior* n. subsp.: Holotype, × 1.

comparison (Figs. 4, 5). Shell larger and more elongate, altogether more crass in test and sculpture. Tubercles same in number, but larger and more projecting, especially on spire-whorls. Shoulder straight or a trifle concave (usually lightly convex in the species). Body-whorl more ample, with a much better marked second keel below peripheral one, spiral cords below periphery stronger and more tubercular.

Height, 72 mm.; diameter, 38 mm.

Habitat.—Warrington beach, near Dunedin (holotype); Taieri Beach, three worn specimens.

Type in Finlay collection.

Murexsul cuvierensis n. sp. (Fig. 2.)

Superficially very close to *M. octogonus* (Q. & G.), but separable at sight by the character of the interstitial ornament. Axials as in *octogonus.* Three main spirals on spire-whorls, uppermost on periphery (at 4/5 height of whorl) with very prominent and sharp projecting spines at summit of axials, relatively much more prominent than in any specimen of *octogonus* I have seen. In *octogonus,* two cords are almost invariably stronger on spire-whorls, the interstitial riblets rapidly grow coarse and strong, obscuring the distinctness of the five main spirals on body-whorl, and there are two or one quite strong cords on shoulder just above periphery. In *cuvierensis,* the interstitial riblets are numerous and minute, quite inconspicuous; this is most strikingly seen in the space between the last basal cord and the two on the canal (there are here two to three prominent spiny cords in *octogonus)* and on the shoulder, where there is no trace of stronger cords.

Height, 15 mm.; diameter, 8 mm.

Habitat.—40 fathoms, off Cuvier Island, the holotype, alive.

Type in Finlay collection.

In view of the number and complexity of the Muricoid groups, and the presence of ancestral forms of *octogonus* in the Tertiary, it seems best to recognise *Murexsul* Iredale *(Trans. N.Z. Inst.,* vol. 47, 1915, p. 471, provided as a subgenus for *M. octogonus* Q. & G. alone, as a full genus. The radular resemblance to *Hexaplex cichoreus* (Gmel.) is not, in this family, so important that it should outweigh strong differential shell characters, especially when the uniformity of the lineage throughout the New Zealand Tertiaries is taken into account.

The Australian Tertiary *M. eyrei* T.-W. *(Proc. Roy. Soc. Tas.* for 1876, p. 93) is very like this species in its spines, but has different spirals: some of these Australian species seem superficially referable to *Murexsul,* but I have seen none so far with the same type of apex. It is paucispiral, smooth, and blunt in both, but in the Australian groups it is also fairly large, with rounded shining whorls, the tip a little adpressed, but still convex. In *octogonus* it is small, of almost two whorls, which are flat vertically, and topped by a fairly sharp keel, past which they slope inwards, so that the summit is quite a marked pit, the tip being rather immersed; the whole surface somewhat roughened, possibly indicating a previous corneous envelope.

New Specific Names for Austral Mollusca.*

By H. J. FINLAY, M.Sc., National Research Scholar in Palaeontology.

[*Read before the Otago Institute, 8th December, 1925; received by Editor, 31st December, 1925; issued separately, 19th January, 1927.*]

THE present paper may be considered as an extension of one published two years ago:—"Some Necessary Changes in Names of New Zealand Mollusca" (*Proc. Mal. Soc. Lond.*, vol. 16, pt. 2, pp. 99-107, 1924), and deals with about 200 additional names. Most of these, of course, are of Australasian shells, with which I am more directly concerned, but there are many others drawn from various sources. Some of the early workers did not realize the vast multitude of molluscan names legally proposed, and the probable insecurity of their simpler combinations; the law of priority unfortunately necessitates the rejection of many of these, and one can make amends only by commemorating the worker in the new specific name wherever possible. If I have not done so in some of the cases to follow, it is because that commemoration has already been made by a previous writer treating of a different species: in a few cases the actual existence of such a combination is not known to me for certain, but is so extremely likely that desire for stability has prompted a less conventional renomination.

The employment of such trivial epithets as *rugosa, nodosa, lirata, plicata, globosa*, etc., is nowadays extremely risky, and certain to cause trouble in the case of the better-known and larger genera. Person and place-names are safest, but there are many uncommon adjectives available, which, in these days of split genera, may be used with fair hope of stability. Most of Tate's names for Australian Tertiary fossils are unassailable on account of wisely chosen appellations; Hutton's species, on the other hand, have suffered frequent name-revision by every worker who has dealt with them. This causes annoyance and confusion, and regrettable loss of the pioneer's specific rights, but the matter is quite unavoidable, and can only be deplored. It is even more a pity when fine and exhaustive monographs, which ought to be monuments of stability for future workers, are marred by injudicious selection of specific names† (apart altogether from generic name-troubles), for which substitutes have consequently to be proposed in out-of-the-way reviews and papers such as this. The only

*For sake of brevity the above title has been adopted, but some new genera are also proposed and there are notes on others, while a few Brachiopod items close the paper. I am deeply indebted to Mr. Tom Iredale, who kindly read the MS. and checked references in many works unavailable to me.

†*E.g.*, Harmer's "Monograph of the English Crag Mollusca," and K. Martin's numerous works on the Javan Tertiaries. It is somewhat curious that the trivial names proposed by the latter writer are either almost unpronounceable place-derivatives, or extremely simple—and therefore generally preoccupied—descriptive adjectives.

mitigation of the evil is to collect as many name-changes as possible in the one paper, for handier reference and compactness, and complete the disagreeable task as thoroughly as possible at the one time. Hence the somewhat heterogeneous character of the present paper, and the excuse for it.

As in my previous paper, the name at the left hand side of each note forms the subject of discussion, while that opposite it on the right (if any) is the necessary substitute here proposed or determined. The first reference given under the name discussed is to the place of its proposal.

As it is my desire to present as complete an account as possible of specific alterations relative to Australasian shells, I have endeavoured to incorporate practically all substitutes proposed since the publication of standard lists of the various faunas. These latter have been regarded as follows:—

1. New Zealand Recent Mollusca,—
   Manual of the New Zealand Mollusca, 1913 (Suter).
2. New Zealand Tertiary Mollusca,—
   Alphabetical List of New Zealand Tertiary Mollusca, 1918 (Suter).
3. Australian Tertiary Mollusca,—
   Catalogue of the Described Species of Fossils, etc., from *Rec. Geol. Surv. Vict.,* vol. 1, pt. 2, p. 89, 1903 (Dennant and Kitson).
4. Australian Recent Mollusca,—
   The Indexes and Check-Lists of the various States: *Queensland,* 1909 (Hedley); *Western Australia,* 1916 (Hedley); *New South Wales,* 1918 (Hedley); and *Tasmania,* 1921 (May).
5. Javan Tertiary Mollusca,—
   Unsere Palaeozoologische Kenntnis von Java, 1919 (Martin).

It is hoped that the summary of changes is complete up to and including 1926 as regards the first three of these, and probably the fifth, but the Australian Recent mollusca have been discussed less fully, most of the alterations having been noted lately by Iredale (*Proc. Linn. Soc. N.S.W.,* vol. 49, pt. 3, pp. 179-278, 1924). As his account deals specially with the Peronian and Maugean faunas and more particularly with the New South Wales list, there are many points he has left untouched in regard to Solanderian shells, but the only alterations to New South Wales and Tasmanian names here noted are a very few that Iredale overlooked.

The most prolific sources of name-changes already made are two French works by M. Cossmann, the *Essais de Paléoconchologie Comparée,* vols. 1-12 (1895-1921), and the *Revue Critique de Paléozoologie,* vols. 1-28 (1897-1924); these are not readily available to many workers, and as notes on Australasian names are scattered throughout, in footnotes, appendices, buried in the text, etc., a complete list of such alterations is obviously a desideratum. This has been compiled and incorporated in the following notes, reference to

which will give any austral name-change instituted in these two works.

It has been considered unnecessary to give separate notes on the alterations proposed (1) by Harris, in the *Cat. Tert. Moll. B.M.*, pt. 1, 1897, (2) by myself in the *Proc. Mal. Soc. Lond.*, 1924. But, for completeness and handiness of reference, a bare list of these is now given, with the page on which they occur; for original references and discussion the papers themselves may be consulted.

HARRIS:

p. 45 *Pleurotoma pagoda* Hutton, 1873 (*non* Reeve): *Pleurotoma alta* Harris, 1897.

*p. 180 *Murex (Ocinebra) alveolatus* Tate, 1888 (*non* Sow.): *Murex (Muricopsis) graniformis* Harris, 1897.

p. 225 *Potamides semicostatum* Tate, 1885 (*non* Desh.): *Cerithium pritchardi* Harris, 1897.

*p. 227 *Cerithium nodulosum* Hutton, 1873 (*non* Brug.): *Cerithium hectori* Harris, 1897.

*p. 229 *Cerithium rugatum* Hutton, 1873 (*non* Mart., *nec* Cpr., *nec* Desh.): *Batillaria pomahakaensis* Harris, 1897.

p. 241 *Turritella (Zaria) tricincta* Hutton, 1873 (*non* Borson *et auct.*): *Turritella kanieriensis* Harris, 1897.

p. 242 *Turritella gigantea* Hutton, 1873 (*non* Bell. *et* Mich.): *Turritella cavershamensis* Harris, 1897.

p. 257 *Natica (Neverita) varians* Tate, 1893 (*non* Dujardin): *Natica cunninghamensis* Harris, 1897.

p. 360 *Venericardia intermedia* Hutton, 1873 (*non* Lamk., *nec* Bast., *nec* Dubois): *Cardita awamoensis* Harris, 1897. (emended to *awamoaensis*, Finlay, *P.M.S.*, 16, 106, 1924.)

FINLAY:

p. 99 *Trochus nodosus* Hutton, 1885 (*non* Meusch., *nec* Forsk.): *Trochus mutus* Finlay, 1924.

†p. 100 *Nerita nitida* (Hutton, 1873) (*non* Donovan): *Nerita pomahakaensis* Finlay, 1924.

p. 101 *Crepidula incurva* Zittel, 1865 (*non* Broderip): *Crepidula wilckensi* Finlay, 1924.

* „ *Natica australis* (Hutton, 1878) (*non* d'Orb.): *Natica maoria* Finlay, 1924.

* „ *Natica callosa* Hutton, 1873 (*non* Gabb): *Polinices intracrassus* Finlay, 1924.

„ *Turritella concava* Hutton, 1877 (*non* Say, *nec* Sow.): *Turritella albolapis* Finlay, 1924.

„ *Cassis striatus* Hutton, 1873 (*non* Meusch., *nec* Sow.): *Cassidea multisecta* Finlay, 1924.

p. 102 *Latirus dubius* Marshall, 1919 (*non* Beyrich): *Latirus (?) marshalli* Finlay, 1924.

„ *Vexillum ligatum* Suter, 1917 (*non* A. Ad.): *Vexillum suteri* Finlay, 1924.

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*Further remarks on these occur in this paper.
†See note elsewhere in this volume.

†p. 102 *Buccinum nodosum* Martyn, 1784 (*non* Solander): *Aethocola raphana* (Lamk., 1829).
p. 103 *Siphonalia turrita* Suter, 1914 (*non* Ten.-Woods): *Aethocola pagoda* Finlay, 1924.
„ *Buccinum carinatum* Hutton, 1873 (*non* Turton): *Cominella errata* Finlay, 1924.
„ *Turris regius* Suter, 1917 (*non* Bolten): *Gemmula waihaoensis* Finlay, 1924.
* „ *Turris neglectus* Suter, 1917 (*non* Reeve): *Turris insensus* Finlay, 1924.
p. 104 *Drillia fusiformis* Hutton, 1877 (*non* Sow.): *Turricula oamarutica* (Suter, 1917).
* „ *Pleurotoma sulcata* Hutton, 1873 (*non* Lamk.): *Pseudotoma huttoni* Finlay, 1924.
„ *Clathurella corrugata* Murdoch, 1900 (*non* Dunker): *Asperdaphne murdochi* Finlay, 1924.
*p. 105 *Conus ornatus* Hutton, 1873 (*non* Michelotti): *Hemiconus trailli* (Hutton, 1873).
* „ *Conus (Conospira) deperditus* Suter, 1917 (*non* Hwass): *Conospira fracta* Finlay, 1924.
„ *Acteon sulcatus* (Hutton, 1885) (*non* Lamk.): *Acteon praestitus* Finlay, 1924.
„ *Pecten subconvexus* Marshall, 1918 (*non* Tate): *Chlamys kaiparaensis* Finlay, 1924.
p. 106 *Venericardia pseutes* Suter, 1917: *Venericardia awamoaensis* Harris, 1879 (emend.).
„ *Mactra attenuata* Hutton, 1873 (*non* Desh.): *Mactra leda* Finlay, 1924.
„ *Mactra dubia* (Hutton, 1873) (*non* Desh.): *Mactra chrydaea* Suter, 1911.
p. 107 *Nucula semistriata* Tate, 1886 (*non* Wood): *Nucula tatei* Finlay, 1924.
* *Leda apiculata* Tate, 1886, (*non* Sow.): *Nuculana chapmani* Finlay, 1924.

To save much space in the frequent quotation of the same periodical, the following abbreviations have been used throughout this paper:—

T.N.Z.I.	*Transactions of the New Zealand Institute.*
T.R.S.S.A.	*Transactions of the Royal Society of South Australia.*
P.R.S.Tas.	*Papers and Proceedings of the Royal Society of Tasmania.*
P.L.S.N.S.W.	*Proceedings of the Linnean Society of New South Wales.*
S.G.R.M.L.	*Sammlungen des Geologischen Reichs-Museums in Leiden.*
E.P.C.	*Essais de Paléoconchologie Comparée.*
R.C.P.	*Revue Critique de Paléozoologie.*
M.P.S.	*Monographs of the Palaeontological Society, London.*

*Further remarks on these occur in this paper.
†See note elsewhere in this volume.

The succeeding items have been jotted down during the last two years. Many more notes have been withheld for future investigation, and will appear in a later paper. There are also numerous names about which I have as yet no data, but which are practically certain to be preoccupied; it will be a long time before such troubles can be dissipated altogether, and the best one can do is to avoid proposing simple combinations oneself.

Haliotis cracherodii new form **imperforata** Dall, 1920:—
Haliotis cracherodii var. **lusus** n. n.
(Proc. U.S. Nat. Mus., vol. 56, p. 370.)

Dall, in employing this name—which appears again in a recent list *(U.S. Nat. Mus. Bull. 112*, p. 184; pl. 21, 1921)—overlooked the fact that both Philippi *(Tert. & Quart. Verst. Chiles*, p. 102, 1887; a synonym of *Crepidula gregaria* Sow.) and Gmelin (in *Linn. Syst. Nat., ed*, 13, I, p. 3690, 1791) had previously proposed *Haliotis imperforata*. A *Haliotis dalli* already exists, so I rename it as above.

Trochus conicus (Hutton, 1883) (*Anthora*):—
Trochus (Coelotrochus) huttoni (Cossmann, 1918).
(T.N.Z.I., vol. 15, p. 411.)

Renamed *Neozelandia huttoni* by Cossmann *(E.P.C.*, vol. 11, p. 220, 1918); I have already dealt with this name *(Proc. Mal. Soc. Lond.*, vol. 16, pt. 2, p. 99, 1924).

Monodonta lugubris (Gmelin, 1791) (*Trochus*).
(Syst. Nat., ed. 13, p. 3583.)

From Peru, Dall has recorded *(Proc. U.S. Nat. Mus.*, vol. 37, p. 239, 1909) *Tegula lugubris* (Philippi, 1844) *(Abbild. u. Beschr. Conch.*, Vol. 1, p. 91), also described first as a *Trochus*, but some other name must be adopted.

There is also a *Monodonta lugubris* Lamarck, 1843 (*Anim. s. Vert.*, ed. 2, vol. 9, p. 180).

Calliostoma cancellatum Finlay, 1923:—
Fautor temporemutata (Finlay, 1924).
(T.N.Z.I., vol. 54, p. 102.)

Renamed *Calliostoma temporemuta (lapsus* for *temporemutata).* n. n. in *T.N.Z.I.*, vol. 55, p. 509, footnote, 1924, on account of prior employment by Schepman *(Les. Siboga Exped.*, Livr. 39, p. 69, 1908), and placed by me* in *Fautor* Iredale.

Liotia serrata Suter, 1908.
(P.M.S., vol. 8, p. 23.)

This has been placed in *Angaria* by Iredale *(T.N.Z.I.*, vol. 47, p. 439, 1915), and in this form would clash with *Delphinula serrata* Buvignier, 1914 *(de Lor. Seq. Tonn.*, p. 63). But as the New Zealand shell is now removed from the Trochidae and placed by me* in a new genus of the Liotiidae, the danger is averted before any complications have ensued.

**Vide* "A Further Commentary on New Zealand Molluscan Systematics," earlier in this volume.

Pseudoliotia imperforata Suter, 1908.
(Proc. Mal. Soc., vol. 8, p. 26).

Cossmann and Pissaro have described a *Liotia (Liotina) imperforata (Pal. Indica,* vol. 3, N.S., mem. 1, p. 80, 1909), and Iredale has noted that *Pseudoliotia* is a synonym of *Liotia (T.N.Z.I.,* vol. 47, p. 440, 1915). However, as I* have stated that Suter's shell is merely the juvenile form of *Modelia granosa* (Mart.), and the original propositions are not homonyms, there is no need for a change.

Cirsonella laevis (Johnston, 1880) (*Adeorbis*).
(P.R.S. Tas. for 1879, p. 33.)

Meyer *(Notes complem. Alab.,* p. 15, 1917) has described an American Eocene shell as *Adeorbis laevis,* which, on account of Johnston's prior use, I now rename *Tornus meyeri* n. n. For *Tornus* Turton and Kingston, 1830 vice *Adeorbis* Searles Wood, 1842, see Iredale, *P.M.S.,* vol. 11, pt. 3, p. 171, 1914.

Turbo (Marmorostoma) approximata Suter, 1917.
(N.Z.G.S. Pal. Bull. No. 5, p. 6.)

Marwick *(T.N.Z.I.,* vol. 55, p. 555, 1924) has referred this to *Natica,* subgenus *Magnatica* nov. In this form it would affect *Natica (Lunatia) approximata* (Etheridge and Bell, MS.) Harmer, 1919 *(M.P.S.,* vol. 73, p. 695), but by giving *Magnatica* generic rank, as I have already done *(T.N.Z.I.,* vol. 56, p. 229, 1926), confusion will be obviated, and no name-changes are necessary.

Turbo etheridgei Tenison-Woods, 1877:— **Turbo tenisoni** n. n.
(P.R.S. Tas. for 1876, p. 98.)

Not *T. etheridgei* Lycett, 1857 *(M.P.S.,* vol. 46, p. 306), an English Oolite species.

Turbo hamiltonensis Pritchard, 1898:—
Turbo grangensis Pritchard, 1909.
(P.R.S. Vict., vol. 17, N.S., pt. 1, p. 329.)

Renamed in *Vict. Naturalist,* vol. 23, p 119, 1906, on account of *Turbo hamiltonensis* Harris, 1897 *(Cat. Tert. Moll. B.M.,* pt. 1, p. 274).

Fossarus minutus (Petterd, 1884) (*Crosseia*).
(Journ. Conch., 1884, p. 139.)

Odhner *(Pap. Mort. Pac. Exped.,* 19, p. 21, 1924) has lately reported this from New Zealand, but actual specimens sent by him are referable to *Notosetia (s.l.).* Petterd's name cannot be maintained in this form, as there is a *Fossarus minutus* Michaud, 1827 *(Bull. Soc. Linn. de Bord.,* vol. 2, p. 122). As, however, the Australian shell was described as a *Crossea,* and is certainly not referable to Fossaridae (May omits the species from his recent catalogue, but in the Addendum suggests that it is the fry of a "*Purpura*"—*Check-List Moll. Tas.,* p. 109, 1922—though this seems unlikely), the matter may be shelved till Petterd's species is placed on a more satisfactory footing.

**Vide* "A Further Commentary on New Zealand Molluscan Systematics," earlier in this volume.

Genus Strebloramphus Tate, 1898:— **Sublacuna** Cossmann, 1899.
(P.R.S.N.S.W., vol. 31, for 1897, p. 401, 1898).

This was published as of " Tate and Cossmann, 1898 " by Tate *(l.c.)*, and must therefore be credited to him, as must also be the specific name, *mirulus*, of the genotype, proposed at the same time. In the *Zoological Record* for 1898, Mollusca, p. 67, the genus is correctly attributed to Tate, as it is also (but with wrong date) by Cossmann *(R.C.P.*, 3, 1899, no. 1, p. 45), who there proposes to replace it by *Sublacuna* nov., *Strebloramphus* having been used by Cabanis for a bird genus. Later (*E.P.C.*, vol. 10. p. 112, 1915) he uses this name, but again incorrectly refers the specific name to Tate and Cossmann, as do also Dennant and Kitson *(Rec. Geol. Surv. Vict.*, vol. 1, pt. 2, p. 112, 1903).

Exactly the same remarks apply to *Chileutomia* " Tate and Cossmann, 1898," and its genotype *C. subvaricosa;* both these must, of course, be referred to Tate as author.

Cocculinella tasmanica May, 1919.
(P.R.S. Tas., 1919, p. 67).

Renamed *C. mayi* on account of *C. tasmanica* Pilsbry, 1895, by Finlay *(Austr. Assoc. Adv. Sci.*, vol. 16, p. 343, footnote, 1923), but Pilsbry's shell is a *Notocrater*, and was described as an *Acmaea*, so that May's name must stand.

Rissoa gradata Hutton, 1885:— **Linemera gradata** (Hutton).
(T.N.Z.I., vol. 17, p. 321.)

The same fate must befall my substitute name for this species. I proposed *Linemera interrupta* n. n. *(T.N.Z.I.*, vol. 55, pp. 481, 483, 1924) on account of a prior *R. gradata* Philippi. This, however, was originally described as a *Cingula*, and as the two shells are now referfed to quite different genera, Hutton's name must be resumed

Rissoa leptalea Murdoch, 1905:— **Notosetia pupinella** n. n.
(T.N.Z.I., vol. 37, p. 228.)

In my paper on New Zealand Tertiary Rissoids, under *Notosetia* sp. cf. *subflavescens* Iredale *(T.N.Z.I.*, vol. 55, p. 488, 1924) is the statement, " The name *Notosetia pupa* nov. is suggested in place of *Rissoa lubrica* Suter, 1898; preoccupied by *R. lubrica* Verrill, 1885." This was a most unfortunuate slip, there being no such species of Verrill's; what I intended to refer to were his *R. leptalea*, 1885, and *R. leptalea* Murdoch, 1905. For the latter form, since *N. pupa* Finlay must be interpreted as a synonym of *N. lubrica* (Suter), I now therefore propose *N. pupinella* n. n.

Cerithium abbreviatum Brazier, 1877:—
Ataxocerithium brazieri Cossmann, 1906.

Hedley *(P.L.S.N.S.W.*, vol. 48, p. 310, 1923) has lately discussed this species, noting that Cossmann *(E.P.C.*, vol. 7, p. 92, footnote, 1906) had proposed *Ataxocerithium brazieri* nom. mut. on the ground of preoccupation by Deshayes. Hedley states, "He does not, however, give the original reference on which Deshayes' name depends, and I am unable to recover it. Apparently Cossmann's synonymy is based on *Melania abbreviata* Defrance *(Dict. Sci. Nat.*, 29, 1823), which is

ineffective"; Hedley therefore restored Brazier's name. Omission of references and erroneous conceptions of original names is usual with Cossmann, but as in many other similar cases, though his data are wrong, his conclusion must stand, for there is a prior *Cerithium abbreviatum* Leckenby, 1858 (*Quart. Journ. Geol. Soc.*, vol. 15, p. 13; pl. 3, Fig. 12) which Hedley overlooked.

Schaffer has also described an Austrian fossil as *Cerithium (Clava) bidentata* Defr. var. *abbreviata* nov. (*Wien. Abh. Geol. Rchs. Anst.*, vol. 22, p. 150, 1912); this is affected by both Leckenby's and Brazier's previous use, and may be renamed *Clava bidentata schafferi* n. n.

Cerithium ickei Martin, 1914:— **Cerithium nanggulanense** Vignal, 1915.

(*S.G.R.M.L.*, n.f., Bd. 2, p. 161.)

Vignal, in bestowing this substitute name (*R.C.P.*, 19, 1915, no 2, p. 93), points out that he had used *Cerithium ickei* himself in 1908 (*R.C.P.*, vol. 12, p. 136) to replace *C. boettgeri* Icke and Martin, 1907, *non* v. Koenen, 1882.

Cerithidea minuta Marshall, 1919:— "**Cerithidea**" **marshalli** Cossmann, 1921.

(*T.N.Z.I.*, vol. 51, p. 226.)

Renamed *Cerittudea* (sic) *marshalli* (*R.C.P.*, vol. 25, 1921, no. 4, p. 181) ,in a paragraph headed "M. Vignal nous écrit," etc., but signed by Cossmann, who, having published it, must be taken as the authority for the new name. It is stated that Gabb used this combination in 1873 for a San Domingo fossil. I have been unable to check most of Cossmann's name changes, as the works to which he refers are mostly unavailable to me; many of those I have looked up have been found erroneous, either as to reference or as to reason for the change. It is therefore probable that some of the names here recorded as substituted by him will have to be dropped and the original names reverted to, when verification of the references can be made. This is often rendered extremely difficult by Cossmann's unscientific habit of rarely quoting references but merely dates, and these are as likely to be wrong as right. The true generic location of the present species is unknown, but it is not a *Cerithidea;* elsewhere in this volume I have doubtfully referred it to my *Zeacumantus.*

Vermicularia nodosa Hedley, 1907:— **Vermicularia hedleyi** n. n.

(*Rec. Austr. Mus.*, vol. 6, no. 4, p. 292.)

Not of Kaunhowen, 1897 (*Gastr. Maestr.*, p. 49).

Turritella acuticarinata (Dunker) Martin, 1905.

(*S.G.R.M.L.*, n.f., Bd. 1, p. 226.)

This was renamed *Turritella martini* by Cossmann (*R.C.P.*, 17, 1913, no. 1, p. 63) on account of Dunker's use of the same name. Later, it is naively noted (*R.C.P.*, vol. 17, 1913, no. 2, p. 128) that his substitute was unnecessary as Martin was merely recording Dunker's species! Martin has also drawn attention to this (*Pal. Kennt. von. Java*, p. 119, note 77, 1919). Dunker's species dates from 1847 (*Palaeontographica*, vol. 1, pt. 3, p. 132) and so invalidates *T. acuti-*

carinata White, 1887 *(Arch. Mus. Nac. Rio de Jan., vol. 7, p. 164),* a Cretaceous species.

Turritella bicincta Hutton, 1873:—**Turritella huttoni** Cossm., 1912. *(Cat. Tert. Moll.,* p. 13.)

Not of S. V. Wood, 1842 (*Ann. Mag. Nat. Hist.,* vol. 9, p. 534), nor of J. de C. Sow., 1850 (in Dixon's *Geol. Sussex,* p. 180). Renamed in *E.P.C.,* vol. 9, p. 113, 1912.

Turritella clathrata Kiener, 1843:— **Gazameda iredalei** n.n. *(Spec. Coquilles,* Turritella, 38.)

This common South Australian shell must have a new name, as Deshayes had used Kiener's epithet in this genus ten years before (in Bory de St. Vincent, *Exp. Morée, Mollusca,* p. 148, 1833).

Turritella difficilis Suter, 1908. *(Proc. Mal. Soc.,* vol. 8, p. 40.)

This name cannot be maintained as it has been used before by d'Orbigny, 1842 *(Pal. franc. Terr. cret.,* p. 39) and Zekeli, 1852 *(Abhandl. Geol. Reichs, Anst.,* vol. 1, pt. 2, p. 23). I do not, however, rename it, as I consider it indistinguishable from *T. rosea* Q. & G.; it certainly is of the same type, and I cannot as yet find any character to separate northern and southern forms.

Turritella ornata Hutton, 1873:— **Batillona amara** n. gen. and n. n. *(Cat. Tert. Moll.,* p. 13.)

Hutton's name had already been selected by Michelotti, 1847 *(Nat. Verh. Holl. Maat. Wet te Haarlem,* 2, 3, 2, p. 195), while Cossmann *(R.C.P.,* vol. 4, 1900, no. 3, p. 144) makes reference to a *Turritella ornata* Munster and also one of d'Orbigny, 1843, neither of which I have so far come across. Had Suter's reference of Hutton's species to the Scalidae *(N.Z. Geol. Surv. Pal. Bull. No. 3,* p. 13, 1915) been correct, the specific name would still have needed amendment on account of *Scalaria ornata* Baily, 1855 *(Quart. Journ. Geol. Soc.,* vol. 11, p. 459). As it is, neither this nor the subsequent reference *(N.Z. Geol. Surv. Pal. Bull. No. 5,* p. 83, 1917) to *Turritella* can be defended; the shell evidently belongs to the Cerithiidae, but cannot be placed in any austral genus already defined. I have a closely related new species from the same locality (Pomahaka, Southland; records from any other locality, e.g., Hampden, seem to be erroneous), while *Cerithium hectori* Harris and *Batillaria pomahakaensis* Harris may also be treated as congeneric. *Batillaria* Benson cannot be used for these shells, while they are certainly not classable as *Cerithium* s. str.; I therefore provide *Batillona* n. gen., and name *B. amara* (n. n. for *Turritella ornata* Hutton, preoccupied) as type. These three species, under this generic name, should be added to the summary of New Zealand Cerithiidae given earlier in this volume, and will then complete the list.

Turritella maculata ornata Schepman, 1909, n. var. *(Res Exp. Siboga,* Livr. 43, Mon. 49b, p. 188), being thus preoccupied several times, may be renamed *Turritella maculata schepmani* n. n.

Turritella simplex Jenkins, 1864:— **Turritella jenkinsi** n. n.
(Quart. Journ. Geol. Soc., vol. 20, p. 59.)

Jenkins' species, originally described from Java, has been recorded by Martin in various lists (e.g., *Tertiar. auf Java*, p. 67, 1879; *Pal. Kennt. v. Java*, p. 95, 1918) while Noetling has determined it from the Miocene of Burma *(Pal. Indica*, N.S., vol. 1, pt. 3, p. 273, 1901). There being no synonymy, the species must receive a fresh name, on account of the prior *T. simplex* d'Orb., 1847 *(Voy. Astrol., Atlas Pal.*, pl. 3, f. 26); it is therefore renamed as above.

Turritella tricincta Morris, 1845:— **Murchisonia bensoni** n. n.
(In Strzelecki's *Phys. Descr. N.S.W.*, p. 285.)

Harris *(Cat. Tert. Moll. B.M.*, pt. 1, p. 241, 1897) has already pointed out the early use of this combination by Borson *(Mem. R. Acc. Sci. Torino* vol. 25, 1820) and others, and renamed Hutton's *T. tricincta* on this account. Dun and Benson *(Rec. Geol. Surv. N.S.W.*, vol. 10, pt. 1, p. 53, 1921) have included in a catalogue of Australian Devonian shells the species *Murchisonia tricincta* (Morris), originally described as a *Turritella*. This, therefore, also needs alteration, and may bear instead the name *Murchisonia bensoni* n. n. Ihering *(Rev. Mus. Paul.*, vol. 2, p. 287, 1897) has also used the term *Turritella tricincta*, but his species is reduced by Ortmann *(Rep. Princ. Univ. Exped. Patagonia*, vol. 4, pt. 2, p. 195, 1902) to a synonym of *T. breantiana* d'Orb., so that Cossmann's substitute, *Turritella iheringi (R.C.P.*, vol. 2, p. 109, 1898), was unnecessary.

Still later proposals of this name occur. Repelin *(Ann. Mus., Marseille*, vol. 10, p. 30, 1906) has proposed a *Turritella tricincta* which I now rename *Turritella repelini* n. n., while for *T. vermicularis* Brocchi var. *tricincta* nov. of Schaffer, 1912 *(Abh. Geol. Rchs. Anst.*, vol. 22, p. 164) I suggest *T. vermicularis praerepta* n. n.

The similar adjective *tricarinata* has also been used several times in this genus, although Brocchi had early appropriated the name, his *Turbo tricarinata (Conch. Foss. Subap.*, vol. 2, p. 374, 1814) being a *Turritella*. Thus Burwash's use of *T. tricarinata* for a Canadian fossil *(Roy. Soc. Canada*, Ser. 3, vol. 7, sect. 4, p. 81, 1914) was illegal and his name may be supplanted by *Turritella burwashi* n. n. In the year following, Dickerson *(Proc. Calif. Ac.*, vol. 5, p. 58) again proposed this name, with another which must also fail: his *Turritella uvasana* var. *tricarinata* I rename *T. uvasana royi* n. n., and his *T. uvasana bicarinata* (not of Eichwald, 1830, *Nat. Lithuaen*, p. 220; Pusch, 1837, *Polens Pal.* 2, p. 104; nor G. B. Sow., 1847, *Quart. Journ. Geol. Soc.*, 3, p. 421) I name *T. uvasana insulsa* n. n.

Capulus angustus Wanner, 1922.
(Pal. Timor, lief. 11, p. 53.)

This may be in danger from *Pileopsis angustus* Philipps, 1836 *(Geol. Yorkshire*, vol. 2, p. 224), but I do not know whether Philipps' shell is really a *Capulus*.

Calyptraea corrugata Tate, 1893:— **Zegalerus tatei** n. n.
(T.R.S.S.A., vol. 17, pt. 2, p. 331.)

This name, employed by Tate for a Muddy Creek fossil, had already been given to a Recent shell by Broderip in 1835 *(Proc. Zool.*

Soc. Lond., vol. 2, no. 17, p. 35). For the genus *Zegalerus* Finlay, based on *Clypeola tenuis* Gray, with which Tate's shell is undoubtedly congeneric, see *antea* this volume.

Spengler *(Mem. Geol. Surv. India, Pal. Indica,* N.S., vol. 8, no. 1, p. 21, 1923) has recently employed the name *Helcion corrugatum* (Forbes), originally described as a *Calyptraea* in 1846 *(Trans. Geol. Soc. Lond.*, vol. 8, p. 137). As Broderip's species invalidates this name also, the substitute *Helcion spengleri* n. n. is proposed. The generic location is due to Stolickza *(Pal. Indica,* vol. 2, p. 323, 1868), but is probably incorrect as the form is a peculiar one.

Natica arata Tate, 1893:— **Globisinum pritchardi** (Cossm., 1907).
(T.R.S.S.A., vol. 17, pt. 2, p. 324.)

On account of Morris and Lycett's use of this name in their "Monograph of the Mollusca of the Great Oolite" (p. 97, 1854), Cossmann *(R.C.P.*, vol. 11, 1907, no. 3, p. 201) has renamed the Australian Tertiary species *N. pritchardi.* The "N" may stand for either *Natica* or *Narica,* as Cossmann refers to both genera, but reference to the index to 1907, no. 4, p. 279, shows that *Natica* is intended. Marwick, however, has noted *(T.N.Z.I.*, vol. 55, p. 574, 1924) that it probably belongs to his new genus *Globisinum,* and examination of my own specimens confirms this.

Natica australis (Hutton, 1879):— **Cochlis australis** (Hutton).
(Journ. de Conch., vol. 26, p. 23.)

On account of the previous *Natica autralis* d'Orb., 1842 *(Voy. Amer. Mer.*, Pal., p. 115) Hutton's species was renamed *Natica maoria* Finlay *(Proc. Mal. Soc.*, vol. 16, pt. 2, p. 101, 1924). It now appears that there is a still earlier *Natica australis,* of Bosc *(s.a. Deterville ed. Buffon,* Moll. 3, p. 292, 1801), but as the American fossil has been reduced by Wilckens *(Fauna der Quir.-Schicht,* p. 196, 1904) to a synonym of *Natica araucana* d'Orb., no change is necessary.

The acceptance of *Cochlis* Bolten—to which the New Zealand Recent shell belongs—as a genus enables us to resume use of Hutton's name, for as his shell was described as a *Lunatia* there is now no clash with the earlier proposals.

Natica callosa Hutton, 1873:— **Uber intracrassus** (Finlay, 1924).
(Cat. Tert. Moll., p. 9.)

This was renamed on account of the prior *N. callosa* Gabb, 1869, *(Pal. Calif.*, vol. 2, p. 10). Gabb was, however, anticipated by J. de C. Sowerby in 1840 *(Trans. Geol. Soc. Lond.,* ser. 2, vol. 5; pl. 26, f. 3) and his species in turn needs renomination, as Cristofori and Jan had appropriated the name in 1832 *(Cat. Mus.*, sect. 2, pt. 1, Conch. Foss., p. 3). As Noetling *(Pal. Indica,* N.S., vol. 1, pt. 3, p. 283, 1901) has reported Sowerby's species from the Burmese Miocene (wrongly synonymizing with it the Javan *N. callosior* Martin), the form he had will probably be reported on shortly by the Indian Geological Survey, since accounts of post-Eocene fossils have lately been appearing in their Memoirs. In the meantime, Sowerby's species may be supplied with the new name *Uber carlei* n. n.

Natica consortis Finlay, 1924:— **Cochlis socius** n. n.
(*T.N.Z.I.*, vol. 55, p. 451.)

The specific name, being a *lapsus for* "*consors*," is preoccupied by Dall, 1909 (*Dept. Int. U.S. Geol. Surv., Prof. Pap. No. 59*, p. 86). The latter name is itself invalidated by *Natica multipunctata* var. *consors* S. V. Wood, 1848 (*Mon. Crag Moll.*, pt. 1, p. 148), so for *N. consors* Dall I propose *Cryptonatica coosensis* n. n.

Natica crassa Schepman, 1909:— **Uber schepmani** n. n.
(*Res. Exp. Siboga*, Livr. 43, Mon. 49b, p. 212.)

Tate having already used this epithet in *Natica subinfundibulum* var. *crassa* (*T.R.S.S.A.*, vol. 17, pt. 2, p. 327), I rename the Siboga shell.

Natica gibbosa Hutton, 1886:— **Uber huttoni** (v. Ihering, 1907).
(*T.N.Z.I.*, vol. 18, p. 334.)

Vide Marwick, 1924 (*T.N.Z.I.*, vol. 55, p. 560).

Natica ovata Hutton, 1873.
(*Cat. Tert. Moll.*, p. 9.)

Klipstein's use of this name in 1843 (*Beitr. z. geol. Kentniss d. ost. Alp.*) has enabled Marwick (*T.N.Z.I.*, vol. 55, pp. 565, 567, 1924) to clear away the confusion surrounding Hutton's name by dropping it altogether and redescribing his complex as two new species, *Uber ovuloides* and *U. obstructus* Marwick.

From Hidaka, Japan, Sowerby has named a shell *Natica ovata* (*Ann. Mag. Nat. Hist.*, ser. 8, vol. 14, p. 35, 1914), which, being doubly preoccupied, may now take the name *Natica japovata* n. n.

Natica solida Sowerby, 1846:— **Uber subsolida** (d'Orb., 1852).
(in Darwin, *Geol. Obs. S. Amer.*, p. 255.)

Hutton in 1886 (*T.N.Z.I.*, vol. 18, p. 334) proposed *Natica darwini* as a substitute name for the South American shell on account of *N. solida* Blainville, 1825 (*Man. Malacol.*, pl. 36, f. 8), and this name has been used by Wilckens (*N.Z. Geol. Surv. Pal. Bull. No.* 9, p. 7, 1922), and still more recently by Marwick (*T.N.Z.I.*, vol. 55, p. 560, 1924). But *Natica subsolida* d'Orb., 1852 (*Prodr. de Paleont.*, vol. 3, p. 39) was proposed for the same purpose, and must be given preference.

Natica variabilis Moore, 1870:— **Euspira eyrensis** n. n.
(*Quart. Journ. Geol. Soc.*, vol. 26, p. 256.)

This common and well-known Australian Cretaceous species has been referred to in many papers (e.g., Etheridge jr., *Mem. Roy. Soc. S.A.*, vol. 2, pt. 1, p. 42, 1902). Trechmann has identified it from New Zealand (*Geol. Mag.*, N.S., dec. 6, vol. 4, p. 299, 1917), but H. Woods (*N.Z Geol. Surv. Pal. Bull* No. 9, pp. 6, 7, 1922) rejects this record, and supplies two new species instead. None of these writers seems to have been aware of the prior *N. variabilis* Reeve, 1855 (*Conch. Icon., vol. 9—Natica*, sp. 104). In the Memoir referred to, Etheridge cites his father's *N. lineata* (*Quart. Journ. Geol. Soc.*, vol. 28, p. 342, 1872) in synonymy, but this name was anticipated by Bolten in 1798 (*Mus. Bolten*, pt. 2, p. 147) and others. I therefore

propose to rename Moore's shell as above, in reference to the Lake Eyre-basin, one of the localities where it occurs.

Polinices ambiguus Suter, 1913.
(*T.N.Z.I.*, vol. 45, p. 296.)

In his recent revision of the New Zealand Naticidae, Marwick (*T.N.Z.I.*, vol. 55, p. 578, 1924) noted that the type of this species could not be found, and therefore dropped it. This is just as well, as it was unrecognizably illustrated and quite obscurely defined; moreover, shells had previously been described under the name *Natica ambigua*, some of which seem referable to *Uber* (= *Polinices*). Meek and Hayden, for example, in 1855 described an American *ambigua*, which Cossmann (*R.C.P.*, 1899 No. 3, p. 136) renamed *N. haydeni* on account of *Natica ambigua* Morris and Lycett, 1854 (*Mon. Moll. Gt. Oolite*, p. 44).

It may be noted that *Natica incerta* Harmer, 1919 (*M.P.S.*, vol. 73, p. 683), proposed in a footnote as an afterthought, is antedated by *N. incerta* Smith, 1906 (*Ann. Mag. Nat. Hist.*, ser. 7, vol. 18, p. 173), and may therefore take the name *Natica suppleta* n. n.

Polinices planispirus Suter, 1917.
(*N.Z. Geol. Surv. Pal. Bull. No. 5*, p. 10).

As in the case of *Turbo approximatus* Suter, the acceptance of *Magnatica* as a full genus removes the specific stumbling-block otherwise present in *Natica planispira* Phillips, 1836 (*Illust. Geol. Yorkshire*, pt. 2 p. 224). Dr. Marwick, on account of this clash, has renamed the New Zealand shell *Natica* (*Magnatica*) *suteri* (*T.N.Z.I.*, vol. 55, p. 555, 1924), but reversion to *planispira* (Suter) will evidently, from the above, become necessary some day, and might as well be made now.

Sigaretus carinatus Hutton, 1877:—
Naricava huttoni (Marwick, 1924).
(*T.N.Z.I.*, vol. 9, p. 597).

Renamed *Micreschara* (*Macromphalina*) *huttoni* by Marwick (*T.N.Z.I.*, vol. 55, p. 578, 1924), who states that it is preoccupied by Goldfuss in 1837 (*Abbild. u. Beschr. d. Petrefakten Deutschlands*, vol. 3, p. 13) and by Muenster in 1842 (*Beitrage zur Petrefakten-Kunde*, vol. 4, p. 93); both these refer to the one shell, and the references are incorrect. The true quotation is:—*Sigaretus carinatus* Muenster, in Goldfuss, *Petref. German.*, vol. 3, pt. 8, p. 13, 1844.

Hutton's shell so closely resembles *Adeorbis angasi* A. Adams, the genotype of *Naricava* Hedley, that there can be no doubt of its belonging to this genus.

Sigaretus undulatus Hutton, 1885:— **Globisinum wollastoni** n. n.
(*T.N.Z.I.*, vol. 17, p. 318).

In the same year as Hutton, Martin (*S.G.R.M.L.*, Ser. 1, Bd. 3, p. 168) described a Javan Miocene shell under the same name. The determination of priority in this case would be a difficult and tedious matter, but fortunately we are relieved from the trouble, as *Sigaretus undulatus* Lischke, 1872 (*Malak. Blatt.*, vol. 19, p. 103) antedates both names and renders substitutes necessary. Hutton's shell I

rename as above; Martin's *S. undulatus* may take the name *Sinum martini* n. n. *Natica (Ampullina) laevis* Hutton, 1885 (*T.N.Z.I.*, vol. 17, p. 317) has been determined by Marwick (*T.N.Z.I.*, vol 55, p. 575, 1924) as merely a worn state of his *undulatus*, but cannot be used to replace it on account of the earlier *Natica laevis* Weerth, 1884, from Neocomian beds; the latter name has also been used by Cossmann (*R.C.P.*, vol. 6, 1902, no. 3, p. 161) as a reason for renaming *Natica laevis* Kaunhowen, 1898 (*Gastr. Maest. Kreide*).

Hutton's and Weerth's proposals also render invalid *Natica levis* E. A. Smith, 1896 (*Ann. Mag. Nat. Hist.*, ser. 6, vol. 18, p. 370). "*Levis*" may mean either "light" or "smooth," but that Smith intended the latter is evident from his diagnosis, the shell being characterized as "*laevigata*," but there being no mention of lightness; his "*levis*" therefore equals "*laevis*," and so is untenable as a species name. I rename his shell—an Indian Ocean form, obtained by the "Investigator"—*Euspira edgari* n. n.

Cypraea amygdalina Tate, 1890:— **Cypraea tatei** Cossmann, 1903.
(*T.R.S.S.A.*, vol. 13, p. 211).

Not of de Grateloup, 1847 (Atlas to *Conch. foss. tert. Adour, Porcellaines*, Pl. 2). Renamed in *E.P.C.*, vol. 5, p. 160, 1903; in the review of this work in *R.C.P.*, vol. 8, 1904, no. 2, p. 115, the substitute name is correctly noted as *C. tatei* (in which form it appeared when originally introduced, the "C." standing for *Cypraea*), but in the index for that year, p. 267, it is given as *Luponia tatei*.

Cypraea ovata Martin, 1879:— **Cypraea bensoni** n. n.
(*Tertiar. auf Java*, p. 21).

Not of Gmelin, 1791 (in *Linn. Syst. Nat.*, ed. 13, 1, p. 3405).

Solarium acutum Tenison-Woods, 1879:—
Architectonica balcombensis n. n.
(*P.L.S.N.S.W.*, vol. 3, p. 236)

Not of Conrad, 1860 (*Journ. Acad. Nat. Sci. Phil.*, N.S., vol. 4), for an American Jacksonian fossil.

Architectonica inornata Marshall, 1917:—
Wangaloa plana (Marshall, 1917).
(*T.N.Z.I.*, vol. 49, p. 452.)

Solarium inornatum d'Orb. from the Antilles will not affect Marshall's species as it is not an *Architectonica*, but the genotype of *Episcynia* Mörch, 1878. There is, however, an *Architectonica inornata* Gabb, 1864 (*Pal. Calif.*, vol. 1, p. 116) to which Marshall's name must yield. At the same time (*l.c.*, p. 453) Marshall described an *Omalaxis planus*, specimens of which in my own collection show it to be the young stage of his *inornatus*. Were the species to remain in *Architectonica*, this name would clash with *Solarium planum* Seeley, 1861 (*Ann. Mag. Nat. Hist.*, ser. 3, vol. 6, p. 287), but as there is no named group of Solarioids which combines the basal and peripheral characters of this species with so planorbid a juvenile stage, the shell in these respects differing widely from all other austral forms, I now dispose of this danger by providing for *Omalaxis planus*

Marshall, 1917 the new genus *Wangaloa.* It is quite likely, however, that there is a prior use of the combination *Omalaxis planus,* all Omalaxids being plane.

Strombus spinosus Martin, 1899:— **Strombus preoccupatus** n. n.
(S.G.R.M.L., n. f., Bd. 1, p. 176).

Not of Linneus, 1767 (*Syst. Nat.,* ed. 12, p. 1212), for a French Eocene Volute.

Scalaria pachypleura Tate, 1890:— **Scala ralphi** (de Boury, 1913).
(T.R.S.S.A., vol. 13, p. 232.)

Renamed by de Boury *(Journ. de Conch.,* vol. 61, p. 65, 1913) on account of prior use by Conrad in 1842.

In conchological work—especially the bibliographical side—humour is infrequent, and thus welcome at any time; no apology therefore seems necessary for the following note.

Harmer, when dealing with the Crag Scalidae, writes under *S. tenuicostata* Michaud, of which he places the prior *S. turtonis* Turton as a synonym, "The specific name of *Turtonae* or *Turtonis* has been rejected of late years in favour of *tenuicostata,* on the ground that an author has no right to describe a new species under his own name or that of any member of his family." Five pages before (*M.P.S.,* vol. 72, p. 536, 1918) Harmer himself publishes—and is therefore the author of—a manuscript species of de Boury under the name of *Scala* (*Clathrus*) *Harmeri.*

Pyramidella polita Martin, 1914:— **Pyramidella nanggulanica** n. n.
(S.G.R.M.L., n. f., Bd. 2, p. 176.)

Johnston used this name in 1880 *(P.R.S. Tas.,* 1879, p. 34) for a Table Cape fossil which May *(P.R.S. Tas.,* 1918, pp. 73, 116) has referred to *Syrnola.*

Turbonilla antiqua Marshall, 1919:—
Turbonilla hampdenensis n. n.
(T.N.Z.I., vol. 51, p. 228.)

Not of Bronn, 1848 *(Index Pal.,* p. 1327). Cossmann *(E.P.C.,* vol. 13, p. 280, 1921) also refers to a *Turbonilla antiqua* Sacco; the complete original reference (for which I have to thank Mr. Iredale) is *Turbonilla costellatoides* var. *antiqua* Sacco, 1892 *(Mem. del. R. Accad. Sci. Torino,* ser. 2, vol. 42, June 30, 1892, p. 78 of reprint).

Pyramidella sulcata Johnston, 1880.
(P.R.S. Tas., 1879, p. 34.)

A. Adams had appropriated this name in Sowerby's *Thes. Conch.,* vol. 2, p. 807, 1855, but May *(P.R.S. Tas.,* 1918, p. 73) has stated, after examining the types, that Johnston's shell is only the juvenile state of his earlier *Ringicula lactea,* so that the name may now pass into oblivion.

There is a "*Turbonilla sulcata* Edwards MS." quoted by Bullen Newton *(Brit. Olig. and Eocene Moll.,* p. 182, 1891), which Cossmann *(R.C.P.,* 1899, no. 3, p. 138) has renamed *T. newtoni* on account of previous use of this name by Briart and Cornet; both name and substitute are, of course, *nomina nuda,* as no description or figure of the

species is extant, Newton merely including an MS. term of Edwards as a list name. Such *nomina nuda* of Cossmann are of frequent occurrence owing to his habit of proposing names in private letters, generally without investigating the status of the name he disagreed with (cf. the note on *Sipho asperulus* Tate); such names have often found their way into printed lists and caused much inconvenience. Fortunately, hardly any New Zealand names have suffered this unscientific treatment. The only *nomina nuda* of this kind so far noted are "*Chione suboblonga* Cossm." and "*C. marshalli* Cossm.," and to these I have already drawn attention (*T.N.Z.I.*, vol. 55, p. 505, 1924). Both names were proposed in a letter to Dr. Marshall (and subsequently recorded in print by him, *T.N.Z.I.*, vol. 49, p. 462, 1917) for shells which had never been described, figured, or previously named. Cossmann gave no descriptions, merely stating that the specimens sent to him differed from the Recent shells with which they had up till then been identified. The species in question are, therefore, rightly being described by Dr. Marwick as new.

Melongena (Pugilina) ponderosa (Martin, 1895) (*Pyrula*):—
Melongena perponderosa Martin, 1919.
(*S.G.R.M.L.*, n. f., vol. 1, p. 92.)

In recently using the above name, Vredenburg (*Mem. Geol. Surv. Ind.*, vol. 50, pt. 1, p. 185, 1925) has overlooked the renomination of this species by Martin six years ago. The transference of the prior *Trophon ponderosum* Gabb to *Melongena (Pugilina)* (Cossmann. *E.P.C.*, vol. 4, p. 90, 1901) necessitated the bestowal of a new name on the Javan shell, and this Martin has supplied in *Melongena perponderosa* n. n. (*Pal. Kennt. von. Java.*, pp. 81, 119, 1919).

Sipho asperulus Tate, 1888:— **Austrosipho asperulus** (Tate, 1888).
(*T.R.S.S.A.*, vol. 10, p. 145.)

In 1901, Cossmann noted (*E.P.C.*, vol. 4, p. 111) that this name would be replaced by his *Siphonalia tatei*. This name, as regards Cossmann himself, is a pure *nomen nudum*, having been proposed, as in the case of *Chione suboblonga* and *marshalli*, in a private letter, and its authorship must be referred to the first legal user. In 1898 both Tate and Cossmann separately reviewed Harris's *Cat. Tert. Moll. B.M.*, pt. 1; in Cossmann's review (*R.C.P.*, vol. 2, 1898, no. 1, Jan., p. 16) occur the words, "*S. tatei* au lieu de *Sipho asperulus* Tate, *non* Desh.," while Tate (*P.R.S.N.S.W.*, vol. 31, p. 385, 1898) writes of the "removal of *Sipho asperulus*....to *Siphonalia*....under the changed name of *S. tatei* Cossmann." Reference to Harris (p. 155) shows that he uses the name validly, but quotes two earlier introductions, "1893, *Siphonalia tatei* Cossm., *in litt.*," and "1893, *id.*, Tate and Dennant, *Trans. Roy. Soc. S.A.*, vol. 17, pt. 1, p. 219." The first of these has, of course, no standing, while in the second case the new name occurs merely in a list of shells, with no information as to what it is or what it supplants. Though this is the first printed introduction of the name, it cannot be construed as a legal proposal, and the first person to state in print that *Siphonalia tatei* equals *Sipho asperulus* Tate is undoubtedly Harris, who must therefore be taken as responsible for the name. But apart from the question of author-

ship altogether, the name seems to be another of Cossmann's needless proposals. Cossmann makes no reference in his "*Essais*" to a *Sipho asperulus* of Deshayes, nor can I find one elsewhere. Apparently he had in mind the *Fusus asperulus* of Lamarck, which, being referred to *Coptochetus,* is quite ineffective. Basing my action on this interpretation, I now restore Tate's name.

The genus *Austrosipho* was proposed by Cossmann (*E.P.C.*, vol. 7, p. 229, 1906) for *Siphonalia roblini* Tate, a Table Cape fossil. As so often occurs, though Cossmann's reasons for proposing the genus were trivial, his name will stand, for this species is representative of a large and well-marked group. This has commonly been called *Verconella,* but the Australian shells so called must take Cossmann's name, for there is no doubt as to the ancestral relationship existing between *A. roblini, A. longirostris,* etc. and Recent forms such as *Siphonalia maxima* Tryon and *S. oligostira* Tate. But I do not think that *Austrosipho* should supersede *Verconella* altogether. *Verconella* was proposed by Iredale in 1914 (*Proc. Mal. Soc.*, vol. 11, p. 175) to replace *Penion* Fischer, which was preoccupied; fortunately the type of that genus was the Neozelanic *Fusus dilatatus* Q. & G., and though at the time Iredale stated that this was absolutely congeneric with *Siphonalia maxima* Tryon, and that Verco had actually gone so far as to synonymize the two, I think appreciable—even generic—differences are observable when one has long ancestral suites for study. Though the shells are so extremely similar in habit, there are valid and constant differences in the apices of Neozelanic and Australian species, and as these are present throughout the Tertiary, I think distinct lines are represented, and that both generic names should be maintained. *Verconella* has a tall, pupoid, polygyrate protoconch, with the nucleus small and central, the whole thing being symmetrically wound; *Austrosipho* has a globular, paucispiral protoconch, quite asymmetrically wound, the nucleus being bulbous and lateral. When one has many ancestral forms for study, other constant differences are also easily observable in the canal, aperture, etc. I have not seen a true *Verconella* yet from Australia, but *Siphonalia excelsa* Suter (*N.Z. Geol. Surv. Pal. Bull. No. 5,* p. 30, 1917) and a new species I have from the Kaipara beds seem to represent *Austrosipho* in New Zealand. There can be no doubt that *Austrosipho* must be recognized; even if these differences do not appeal to some as of generic rank, Cossmann's name has eight years clear priority over Iredale's.

Fusus bicinctus Kaunhowen, 1898:— **Colus (?) kaunhoweni** n. n.
(*Gastr. Maestr. Kr.*, p. 32.)

Not of Hutton, 1873 (*Cat. Mar. Moll.,* p. 10), whose use of this name for a New Zealand Recent shell makes it necessary to supply a new one for the Austrian fossil.

Fusinus corrugatus Marshall, 1918.
(*T.N.Z.I.,* vol. 50, p. 264.)

There is a *Fusus corrugatus* Reeve, 1848 (*Conch. Icon.*, vol. 4—*Fusus,* no. 84), but as it is certainly not congeneric with the New Zealand fossil, Marshall's name may be allowed to stand.

Fusus exilis (Tate, 1888) *(Fasciolaria)*:— **Brocchitas exilis** (Tate). *(T.R.S.S.A.*, vol. 10, p. 149.)

Cossmann has renamed this *Streptochetus adelomorphus (E.P.C.*, vol. 4, p. 31, 1901) on account of prior use of *Fusus exilis* by Conrad for an American Miocene species. Since Tate described his shell as a *Fasciolaria,* and the two shells are not congeneric, this is not a valid reason, and Tate's name must be resumed. There is also a *Fusus exilis* Menke, 1843 *(Moll. Nov. Holl.*, p. 26), included by Hedley in his Queensland list (p. 58, 1916), but I do not know how this is affected by Conrad's proposal, the date of which is unknown to me.

The generic placing of this shell gives considerable trouble. The first change from the original *Fasciolaria* was made by Harris *(Cat. Tert. Moll. B.M.*, pt. 1, p. 137, 1897) who likened the Australian shell to *Fusus incertus* Desh., and therefore referred it to *Streptochetus;* in this course he was followed by Cossmann *(l.c.).* Tate *(P.R.S. N.S.W.*, vol. 31, p. 384, 1898) rightly objected to this location, and decided that the species should be referred instead to *Latirofusus* Cossmann, 1889. The first introduction of this generic name into austral lists was made by Tate in 1891 when he described a new Recent species *(T.R.S.S.A.*, vol. 14, pt. 2, p. 258) from South Australia as *Latirofusus nigrofuscus* nov.; he later *(l.c.*, vol. 17, p. 198, 1893) noted that Tenison-Woods' *Fusus spiceri* was equivalent to his shell, but rejected the name on account of inadequacy of diagnosis; later workers, however, such as Hedley and May, have given preference to the earlier name, and as *Latirofusus spiceri* (Ten.-Woods, 1877) this species occurs in the Check-Lists of Tasmania and the three south-eastern States. To continue the history of *Latirofusus;* Tate, in 1894 *(P.R.S.N.S.W.*, vol. 27, p. 171, 1894) then used it, on Cossmann's suggestion, for an Australian Tertiary fossil, his *Fusus aciformis,* and subsequently, as noted earlier, also referred to it his *Fasciolaria exilis,* chiefly on account of its similarity to *L. funiculosus* (Lk.), the genotype, and these have remained there since. Unfortunately I have not seen *spiceri* and *aciformis,* so cannot say if these three are congeneric, or if not, how many groups are represented, but *exilis* seems to me quite distinct from *Latirofusus,* and very probably that genus is not represented in austral waters at all; Tate seems to have been swayed by Cossmann's reference of *F. lancea* Gm. and *acus* Ad. & Reeve to the genus, but it remains to be seen whether these are really related to the Parisian Eocene genotype, with which alone comparison should be instituted. Harris *(l.c.)* in comparing *aciformis* with *funiculosus* (Lk.) states that it is "proportionately narrower, and does not possess the latiriform longitudinal costae so characteristic of the Paris Basin shell. The protoconch of the latter is relatively much smaller, and the shell as a whole is more solid." Written descriptions of the two shells would read much alike, but would convey a wrong impression, for the whole facies is totally different; *Latirofusus* is, as its name implies, a but slightly modified *Latirus,* with the characteristic shell-texture and axial ornament of that genus, while I can read no relation to *Latirus* into the figures and descriptions of *aciformis* and *spiceri.* With regard to *exilis,* it may be noted that neither Harris nor Cossmann thought of referring

it to *Latirofusus,* though they referred other species there at the same time; the differences in this case seem to be still more marked, and this suggests that perhaps another group is represented. Not being able, therefore, to find a satisfactory location for *Fasciolaria exilis* Tate, I now propose for it the new genus *Brocchitas;* if *Fusus spiceri* T.-W. is congeneric it will take this name also, but if, as seems likely, it represents a different group, a name other than *Latirofusus* will be necessary. It is perhaps of interest to mention that Cossmann many years ago rejected *Latirofusus* (*E.P.C.*, vol. 4, p. 22, 1901) as a synonym of *Dolicholatirus* Bellardi, 1883 (G.-T., *Turbinella bronni* Mich., Miocene). This generic name has been used by Marshall for a Pakaurangi Point fossil (*T.N.Z.I.*, vol. 50, p. 264, 1918), at Suter's instigation, but the name must be rejected; the relationships of this species will be dealt with in another place.

One other genus must be considered before this rather lengthy note can be concluded, and that is *Exilia* Conrad. This name is well known to New Zealand students, as Suter has described three Tertiary species under it. Its use is due indirectly to Dr. Dall, who wrote to Suter that a shell sent to him resembled *Plicifusus* and *Exilia;* Suter has quoted his remarks (*N.Z. Geol. Surv. Pal. Bull. No. 3,* p. 19, 1915), which, owing to misplacement of the second quotation mark (it should come after the word "fauna"), appear somewhat contradictory. Dall draws attention to Cossmann's error (*E.P.C.*, vol. 4, p. 26, 1901) in stating that *Exilia* has two columellar plaits, and in another place (*U.S. Geol. Surv. Dept. Int., Prof. Pap. 59,* p. 37, 1909) says, "The supposed plaits on the pillar mentioned by Cossmann are due to some misapprehension, as there is not a trace of any sculpture or plaiting on the pillar." In his remarks on *Exilia dalli* n. sp., however, Suter says (*l.c.*), "As stated in the diagnosis, my specimen has two columellar plaits. However, I must confess I might not have seen them if I had not especially looked for them in consequence of Cossmann's statement." This is an excellent example of how one can see what one wishes to see if one looks long enough. None of the three species Suter described as *Exilia* show any sign of two plaits in either the adult or the juvenile state; but all have a blunt subangulate twist on the pillar at the inception of the canal. In other ways, too, the form of the aperture is different from *Exilia,* and abundantly so from *Plicifusus,* which seems to be the evolutionary product of *Exilia.* It is evident that the New Zealand forms are wrongly referred to this genus, and there does not seem to be a better one, the *Mitraefusus* of Bellardi being just as inapplicable. I therefore now provide *Zexilia* new genus, with *Exilia waihaoensis* Suter, 1917 (*N.Z. Geol. Surv. Pal. Bull. No. 5,* p. 25) as type, and locate there also *E. dalli* Suter and *E. crassicostata* Suter. Tate's figure of *Fusus aciformis* (*T.R.S.S.A.*, vol. 10, p. 139, pl. 7, figs. 5a, b, 1888) looks very like a *Zexilia,* but reference here depends on whether there are plaits on the pillar; Tate mentions none, but Harris says there are two, in which case it will be congeneric with either *spiceri* or *exilis.* *Latirofusus cingulatus* Pritchard, from Table Cape, is almost exactly like the type of *Latirofusus* (*funiculosus* Lk.) but lacks the two

oblique plications; it may, in the meantime, be referred to *Zexilia,* though the aperture is not in close accord.

Fusus hexagonalis Tate, 1888.

(T.R.S.S.A., vol. 10, p. 139.)

There is a prior *F. hexagonus* J .de C. Sowerby, 1839 *(Trans. Geol. Soc. Lond.,* ser. 2, vol. 5, pl. 26, f. 15), but the epithets are sufficiently distinct to allow the retention of Tate's name. It may be noted that Sowerby's species has recently been renamed *Muricopsis exhexagonus* by Vredenburg, 1925 *(Mem. Geol. Surv. India,* vol. 50, pt. 1, p. 220), on account of its clashing with *Muricopsis hexagonus* (Lamk.) *(Murex),* when transferred to this genus.

Fusus plicatilis Hutton, 1873:—

Pomahakia aberrans n. gen. and n. n.

(Cat. Tert. Moll., p. 3.)

As a synonym of *Murex turricula* Montfort, Searles Wood has published *(Mon. Crag. Moll.,* pt. 1, p. 62, 1848) *Fusus plicatilis* as a manuscript name of Bean. Under the nomenclatural rules, *Fusus plicatilis* S. V. Wood, 1848 is therefore a valid name and stands as a substitute (synonym) for *Propebela turricula* (Mont.). It therefore invalidates Hutton's name, which I replace as above. The peculiar facies and outer-lip sinus of this Pomahaka fossil (of which no allies are at present known) renders necessary the creation of a new name *Pomahakia* for it; the exact value of the group, as also its family location, are at present doubtful; it may be a Turrid, but I would suggest tentative reference to the Neptuniidae, perhaps near *Verconella.*

Fusus spiniferus Tate, 1888:—

Columbarium spinulatum Cossm. 1901.

(T.R.S.S.A., vol. 10, p. 134.)

Renamed by Cossmann *(E.P.C.,* vol. 4, p. 16, 1901) who states that Bellardi had used this name previously for an Italian Miocene species. Mr. Iredale has kindly supplied me with the reference, which is as follows, "*Fusus spinifer* Bellardi, 1873 *(I. Moll. Terr. Terz. Piem e Lig.,* pt. 1, p. 133; *Mem. Accad. Sci. Torino,* ser. 2, vol. 27).

Mitra clathrata Reeve, 1844.

(Conch. Icon., vol. 2—*Mitra* No. 71.)

This name occurs in Hedley's Queensland list (p. 59, 1909) but is preoccupied by Defrance, 1824 *(Dict. Sci. Nat.,* vol. 31, p. 493), while both names upset Reuss's usage in 1845 *(Verst. boehm. Kreidef.,* vol. 1, p. 44). There are probably available synonyms.

Mitra cancellata Sow., 1832 *(Trans. Geol. Soc. Lond.,* ser. 2, vol. 3, p. 419), which has been recently recorded by Spengler *(Pal. Indica,* N.S., vol. 8, Mem. 1, p. 43, 1923) from the Cretaceous of Assam, is invalidated by two previous uses, Swainson in 1821 *(Zool. Illust.,* 1, 1, pt. 5, pl. 29), and Bolten in 1798 *(Mus. Bolten,* pt. 2, p. 138). As Spengler quotes *Rostellaria crebricostata* and *Voluta cristata,* both of Zekeli, 1852, as synonyms, the choice of an alternative will fall on one of these.

Mitra exilis Tate, 1889.
(T.R.S.S.A., vol. 11, p. 140.)

I propose *Balcomitra,* new genus, for the group represented by *Mitra paucicostata* Tate, which I nominate as type; this will include most of the Australian Tertiary species referred by Tate to *Costellaria,* e.g., *leptalea, exilis,* etc. For the latter, which is preoccupied by *Mitra exilis* Reeve *(P.Z.S.,* 1845, pt. 13, no. 147, p. 58), I suggest *Balcomitra macra* n. n. The group is related to *Austromitra* Finlay,* but as that covers a large and uniform group of late Tertiary and Recent shells, while the Balcombian forms are also numerous and uniformly differ in longer and better-developed snout and keel-like spiral sculpture on base, it is necessary to have a name for each assemblage to avoid confusion and erroneous conceptions of distribution. *Balcomitra* does not occur in New Zealand; the Recent and Tertiary *Egestas** has a similar shape and pronounced snout, but only three pillar-plaits.

Mitra ligata Tate, 1889:— **Microvoluta pentaploca** n. n.
(T.R.S.S.A., vol. 11, p. 139.)

Not of A. Adams, 1853 *(Proc. Zool. Soc.* for 1851, pt. 19, no. 227, p. 134). Tate's species is essentially the same type of shell as the Recent *Microvoluta australis* Angas, 1877, having the same characteristic surface, aperture, and twisted beak; it is also quite close to the New Zealand Pliocene and Recent *Turricula marginata* Hutton, but in the adult state has five plaits, the fifth being anterior, weak, and evanescent. The species has generally been located in *Conomitra* by Australian authors, following Harris *(Cat. Tert. Moll. B.M.,* pt. 1, p. 130, 1897), who compared it to the smooth Paris Basin forms such as *C. marginata* (Lk.); the resemblance is, however, very slight and superficial, the French shell being far more like the New Zealand early Tertiary *Mitra inconspicua* Hutton, which bears no relation to *ligata* Tate, but which I have compared to his *complanata (T.N.Z.I.,* vol. 55, p. 468, 1924), and made the type of a new genus *Waimatea.**

Iredale has recently shown *(P.L.S.N.S.W.,* vol. 49, pt. 3, p. 269, 1924) that *Microvoluta* should be transferred to the Volutidae.

Mitra multisulcata Sowerby, 1914:— **Mitra subruppeli** n. n.
(Ann. Mag. Nat. Hist., ser. 8, vol 14, p. 476.)

Described from New Caledonia, and compared with *M. ruppeli* Rve., but the name chosen had been appropriated by Harris *(Cat. Tert. Moll. B.M.,* pt. 1, p. 120, 1897) for an Australian Balcombian fossil.

Mitra semilaevis Tate, 1889:— **Mitra ralphi** Cossm., 1900.
(T.R.S.S.A., vol. 11, p. 143.)

Renamed "*M. tatei*" by Cossmann *(E.P.C.,* vol. 3, p. 165, April, 1899) on account of Edwards's prior use in 1849 *(Mon. Eoc. Moll.,* 183); the "M." here stands for *Mitra,* though in his review of this volume of the "*Essais*" *(R.C.P.,* vol. 3, 1899, No. 4, October, p. 144) the substitute name is given first as *Turricula tatei,* then later *(l.c.,* p. 193) as *Costellaria tatei!* Angas, however, had already proposed

*See earlier in this volume.

for a Recent South Australian shell the name *Mitra tatei* in 1879 *(Proc. Zool. Soc.* for 1878, p. 861), and, discovering this, Cossmann proposed *(R.C.P.*, vol. 4, 1900, No. 4, p. 186) a new substitute, *Mitra ralphi,* for the Australian fossil.

Mitra uniplica Tate, 1889:— **Mitra monoploca** n. n.
(T.R.S.S.A., vol. 11, p. 138.)

Mitra ebenus (?) var. *uniplicatus* S. Wood, 1872 *(Mon. Crag. Moll.*, p. 7) will dispose of this name. "Uniplica" and "uniplicata" cannot be allowed as distinct epithets, being of the same standing as, for example, "rotunda" and "rotundata," "planicosta" and "planicostata," etc., which terms are quite fortuitously used by authors.

Thala marginata Tenison-Woods, 1877.
(P.R.S.Tas. for 1876, p. 108.)

Some confusion surrounds this Table Cape fossil. Tate *(P.R.S. N.S.W.* for 1897, vol. 31, p. 396, 1898) did not accept the name, but argued for, and proposed, a new one as follows:—

"*Cordieria conospira* spec. nov. (Plate 19, fig. 12.)
Thala marginata Tenison-Woods (*P.R.S.Tas.*, 1877, p. 108).

The transference of the Table Cape species, described by Tenison-Woods as *Thala marginata,* to either *Borsonia* or *Cordieria* renders a change of specific denomination ("necessary," *omitted inadvertently). Borsonia marginata* was described by Deshayes in 1864 and was included by Cossmann in his section *Phlyctoenia,* which was subsequently recognized by him to be synonymous with *Cordieria;* in M. Cossmann's work *(E.P.C.*, vol. 2, p. 100, 1896) it is listed as *Cordieria marginata.*"

Now, since Deshayes's and Tenison-Woods's names are not homonyms, the preoccupation lasts only so long as both are retained in the same genus, and I have already *(T.N.Z.I.*, vol. 55, p. 499, 1924) stated that the Australian shells are congeneric with some New Zealand species, for which I proposed the genus *Rugobela (l.c.*, p. 514), widely removed from *Borsonia.* The point now arises,—is Tate's *conospira* to be taken as a proposed new species, with which he (rightly or wrongly) synonymizes *Thala marginata* T.-W., or must it be regarded as a substitute name for the latter? If the last view is upheld, the name is unnecessary, for, apart altogether from the validity or otherwise of *marginata,* May *(P.R.S.Tas.* for 1918, pp. 72, 113) has recorded from examination of types that *T. marginata* is synonymous with *Daphnella columbelloides* Ten.-Woods, described three pages earlier. *Rugobela columbelloides* (T.-W., 1877) is, therefore, the correct name for the Table Cape form, whatever one argues in respect to the shells Tate studied. I have been unable to separate a series of Balcombe Bay specimens specifically from four Table Cape topotypes, and if this view is upheld, further discussion is satisfactorily obviated. Were two species represented, the standing and validity of Tate's name would remain an annoying subject for debate, but fortunately all specimens I have seen so far seem to be referable to *columbelloides* (T.-W.).

Buccinum meridionale inflata Harmer, 1913:— **Buccimum tumescens** n. n.
(*M.P.S.*, vol. 67, p. 112.)

Invalidated by *Buccinum inflatum* Hutton, 1873 (*Cat. Tert. Moll.*, p.6), while *Buccinum undatum minimum* Harmer, 1913 (*l.c.*, vol. 68, p. 97) must fall before two earlier proposals of the same name, also for British shells, viz., Montague, 1803 (*Test. Brit.*, pt. 1, p. 247), and Turton, 1802 (*Gen. Syst. Nat.*, vol. 4, p. 387); *B. undatum minusculum* n. n. may replace it.

Tritonidea fusiformis Verco, 1896.
(*T.R.S.S.A.*, vol. 20, p. 219.)

This was described by Verco from South Australia, with a variety *adcocki*, but his name had already been chosen for a Javan fossil by Martin, 1883 (*S.G.R.M.L.*, ser. 1, p. 206). Hedley (*P.L.S.N.S.W.*, vol. 38, pt. 2, p. 316, 1913) synonymizes Verco's species with *T. subrubiginosa* Smith, 1879 and *Pisania bednalli* Sow., suggesting that *Purpura glirina* Blainv., 1832 and *Buccinum discolor* Kiener, 1834 may also refer here. No substitute need therefore be proposed for Verco's name at present; if the South Australian forms are later racially recognized, they will take the name *adcocki*. These forms seem referable to *Tasmeuthria* Iredale, proposed for *Siphonalia clarkei* Ten.-Woods (*Rec. Austr. Mus.*, vol. 14, no. 4, p. 202, 1925).

Latirus fusiformis Tesch, 1915:— **Colus (?) teschi** n. n.
(*Pal. Timor*, lief. 5, pt. 9, p. 55).

The canal of this Timor fossil seems too long and straight for reference to *Latirus*; in the specific name Tesch had been anticipated by Hoernes and Auinger, 1891 (*Gastr. Meeres-Abl. Mio. Medit.*, etc., lief. 6, p. 270).

Nassa ovum Cossmann, 1902.
(*Journ de Conchyl.*, vol. 50, no. 4, p. 138.)

As the Pliocene molluscs of Karikal are now being re-examined and Cossmann's species-names frequently used in recent publications of the Geological Survey of India, it is as well to record here that Martin (*Pal. Kennt. von Java*, p. 119, 1919) has drawn attention to his own previous employment of this combination, and in consequence has renamed the French Indian fossil *Nassa francoindica*.

Murex alveolatus Tate, 1888:— **Murex graniformis** Harris, 1897.
(*T.R.S.S.A.*, vol. 10, p. 108.)

As J. de C. Sowerby had long ago used this name for a British Eocene species (*Min. Conch.*, vol. 5, p. 9, 1823), Cossmann (*R.C.P.*, vol. 11, 1907, No. 3, p. 200) has renamed the Australian shell *Muricopsis subalveolatus* n. n. He overlooked the fact that Harris had already dealt with the matter (*Cat. Tert. Moll. B.M.*, pt. 1, p. 180) and, on the same grounds, had proposed ten years previously the substitute *Murex (Muricopsis) graniformis*.

Murex irregularis Tate, 1888:— **Hadriania basedowi** Cossm., 1903.
(*T.R.S.S.A.*, vol. 10, pp. 102.)

Pleading that Bellardi had used this name in 1872, Cossmann (*E.P.C.*, vol. 5, p. 46, 1903) has proposed the above substitute; I give

it as he wrote it, though a different generic location will be required when the group is revised. The correct reference to Bellardi's name (sent me by Mr. Iredale) is *I. Moll. Terr. Terz. Piem. e Lig.*, pt. 1, p. 128, 1873 (reprint); *Mem. del R. Acc. Sci. Torino,* ser. 2, vol. 27).

Trophon crispus (Gould, 1849) (*Fusus*).
(Proc. Bost. Soc. Nat. Hist., vol. 3, p. 141.)

Marwick *(T.N.Z.I.*, vol. 55, p. 199, 1924) has recently renamed the New Zealand shell *Xymene oliveri,* stating his reasons as follows: "Cossmann (*E.P.C.*, vol. 5, p. 54, footnote, 1903) changed *Trophon crispus* (Gould) to *Trophon gouldi,* giving as his reason, 'Cette denomination fait double emploi avec celle d'un *Murex* bien antérieur, dans l'Eocene du Bassin de Paris; l'espèce néozélandaise doit donc recevoir un autre nom.' Now the shell in question was described originally as *Fusus crispus,* so there is no justification for changing the specific name, as the Parisian shell is still retained under *Murex.* *T. gouldi,* however, cannot be applied to the New Zealand shell; it was definitely proposed as a substitute for *T. crispus,* and must be associated with that South American species."

This solution of the problem cannot stand. First, the combination *Fusus crispus* is itself preoccupied by Borson, 1820, for an Italian fossil *(Oritt. Piedmont,* p. 317; discussed by Michelotti, 1847, *Descr. des Foss. Mioc. de I'tal.*, p. 272), so Gould's name must be changed. Secondly, the name *Trophon gouldi* was proposed by Cossmann *for the New Zealand species,* and not as a substitute for *Trophon crispus* Gould. Cossmann's own statement is, "l'espèce néozélandaise doit donc recevoir un autre nom, et je propose en conséquence: *Trophon Gouldi* nobis," while he cites in the passage to which this footnote refers, "la Monographie de M. Hutton *(loc. cit.*, Pl. VI., fig. 8)." This citation of a specific locality and figure fixes the name *Trophon gouldi* Cossmann definitely on the New Zealand species; as Dr. Marwick has shown that the latter differs from the South American form, this is the name it must bear; *Xymene oliveri* Marwick thus becomes a synonym. It is evident that Suter also came to this conclusion, from his statement *(Man. Mollusca,* p. 419), "Allied to the Pliocene *T. gouldi* Cossm. (=*crispus* Hutt., not of Gould)."

Cossmann referred the species to *Trophonopsis,* but it belongs to the group for which I have (earlier in this volume) proposed *Xymenella,* with *Trophon pusillus* Suter as type, and should, therefore, finally be called *Xymenella gouldi* (Cossmann).

Since the name *crispus* cannot be maintained for the South American species, it becomes necessary to look for a substitute. This appears to be available in *Fusus fimbriatus* Hupe, in Gay, *(Hist. de Chile,* vol. 8, p. 165) which is recorded by Melville and Standen *(Ann. Mag. Nat. Hist.*, ser. 8, vol. 13, p. 119), as a synonym of *T. crispus.*, though Smith *(P.Z.S.*, 1881, p. 28) thought it distinct. It is quite likely, however, that there are previous users of this name also, but I have not yet come across one.

The vicissitudes of the New Zealand *gouldi* may be condensed into the following synonymy:—

Xymenella gouldi (Cossmann, 1903).

1886. *Trophon crispus* Gould: Hutton, *T.N.Z.I.*, vol. 18, p. 347; not of Gould.
1893. *Trophon crispus* Gould: Hutton, *Macleay Mem. Vol.*, p. 40, pl. 6, fig. 8; not of Gould.
1903. *Trophon gouldi* Cossmann, *Ess. de Pal. Comp.*, livr. 5, p. 54, nom. nov. for the New Zealand shell figured by Hutton in 1893.
1913. *Trophon gouldi* Cossmann: Suter, *Man. N.Z. Moll.*, p. 419.
1918. *Trophon gouldi* Cossmann: Suter, *Alph. List N.Z. Tert. Moll.*, p. 29.
1924. *Xymene oliveri* Marwick, *T.N.Z.I.*, vol. 55, p. 199.
1927. *Xymenella gouldi* (Cossmann, 1903): Finlay, *T.N.Z.I.*, vol. 57, p. 511.

Thais alveolata (Reeve, 1846).
(*Conch. Icon.*, vol. 3—*Purpura* no. 6 (=60).)

In the "Index of the Mollusca of Western Australia," Hedley includes (pp. 63, 64) *Engina alveolata* (Kiener) and *Thais alveolata* (Reeve). As each of these is based originally on the name *Purpura alveolata*, they cannot both stand, Kiener's name (*Spec. Coquilles, Purpura*, p. 42, 1836) has ten years priority, so that Reeve's shell must receive a new name.

Cancellaria neglecta Martin, 1895:—**Bivetia martini** Cossmann, 1899.
(*T.R.S.S.A.*, vol. 11, p. 155.)

On account of previous usage by Hoernes (no date or reference given), Cossmann (*E.P.C.*, vol. 3, 1899, No. 1, p. 24) renamed Tate's species *Aneurystoma tatei*, but I have noted elsewhere (*T.N.Z.I.*, vol. 55, p. 501) that this shell and *ptychotropis* Tate are the Australian representatives of *Admete suteri* Marshall & Murdoch, the genotype of my genus *Oamaruia* (*l.c.*, p. 514). To these may also be added a Recent survival, *Cancellaria pergradata* Verco, 1905 (*T.R.S.S.A.*, vol. 29, p. 142), described from South Australia as the descendant of *gradata* Tate, and reported also from Tasmania by May; further Tertiary species of this distinct group are known to me from Australia.

Cancellaria neglecta Martin, 1895:—**Bivetia martini** Cossmann, 1899.
(*S.G.R.M.L.*, n. f., Bd. 1, pp. 47, 296.)

Cossmann thus replaced Martin's name (*E.P.C.*, vol. 3, p 10), stating that Michelotti had previously used it in 1861.

Voluta alticostata Tate, 1889:— **Livonia alticostata** (Tate, 1899).
(*T.R.S.S.A.*, vol. 11, p. 122.)

In Dennant and Kitson's "Catalogue of the Described Species of Fossils, etc." (*Rec. Geol. Surv. Vict.*, vol. 1, pt. 2, p. 100) appears the name *Voluta validicostata* Tate, with a footnote, "Nom. mut., *V. alticostata* Tate." The substitute name must, of course, be credited to Dennant and Kitson, but no reason is given for the change, nor does any seem to be mentioned elsewhere in Australian literature. Pritchard (*P.R.S.Vict.*, vol. 26, pt. 1, p. 199, 1913) and May (*P.R.S.Tas.*, 1918, p. 112), when recording the Table Cape species, seem not to have noticed the substitute name, as *alticostata* is included without remark. As a matter of fact, they are correct in retaining

the original name, for Tate's reason for rejecting his name seems to have been the discovery that White, two years previously, used the same specific name for a Senonian Brazilian Volute *(Arch. Mus. Nac. Rio Janeiro,* vol. 7, p. 127). White, however, proposed *Volutilithes alticostatus,* and this does not clash with Tate's name, which I now restore. In placing the species in *Livonia* Gray, I would remark that though Hedley synonymized *Pterospira* Harris with this genus, it seems distinct enough to be used at least as a subgenus, the rather numerous Tertiary forms all having much stronger ornament than *L. mamilla,* the type of *Livonia,* and a rather different facies.

Voluta capitata Tate, 1889:— **Scaphella macrocephala** n. n.
(T.R.S.S.A., vol. 11, p. 127.)
Not of Perry, 1811 *(Conchology,* Pl. 17.)

Voluta (Lyria) corrugata Hutton, 1873.
(Cat. Tert. Moll., p. 7.)

This is a very unsatisfactory species. Marwick, who has just lately dealt with it *(T.N.Z.I.,* vol. 56, p. 299, 1926), refers it to *Alcithoe,* near *A. solida* Marwick, but remarks that, "Until some topotypes have been secured, however, the best course is to ignore the species." This indeed must be done, as there is a prior *Voluta corrugata* Binkhorst, 1861 *(Monogr. Gastr. et Ceph. craie de Limbg.,* p. 14). This conveniently solves the problem, and allows us to describe the species as new when better specimens are collected.

Voluta elongata Swainson, 1821:—
Alcithoe swainsoni Marwick, 1926.
(Exot. Conch., pl. 20, f. 21.)

I have noted at least four users of this name. The first was Solander, 1786 *(Cat. Port. Mus.,* p. 30), the next Swainson, as above; for his shell Marwick has supplied the substitute *Alcithoe swainsoni* nom. nov. *(T.N.Z.I.,* vol. 56, p. 294, 1926). D'Orbigny then employed the name for a Cretaceous fossil *(Pal. Franc. Cret.,* vol. 2, p. 323, 1843); as *Fulguraria elongata* (d'Orb.) this has been recorded from the Cretaceous of Southern India by Stolickza *(Pal. Indica,* vol. 2, p. 87, 1868), who reduces *Voluta trichinopolitensis* Forbes, 1846 *(Trans. Geol. Soc. Lond.,* vol. 7, p. 133) to a synonym; if his action is correct, this is the name to be adopted for the species. Lastly, Pease in 1867 *(Am. Journ. Conch.,* vol. 3, p. 281) described a fourth *Voluta elongata,* but I do not know its present status.

Fulguraria morgani Marshall and Murdoch, 1920:—
Alcithoe gatesi Marwick, 1926.
(T.N.Z.I., vol. 52, p. 133.)

Not of Cossmann and Pissaro, 1905 *(Faune Eoc. du Cotentin,* t. 2, f. 3, p. 76). Renamed by Marwick in *T.N.Z.I.,* vol. 56, p. 302, 1926.

Voluta polita Tate, 1889.
(T.R.S.S.A., vol. 11, p. 129.)

Cossmann *(E.P.C.,* vol. 3, p. 127), stating that Conrad had previously used this name, renamed the Australian fossil *Scaphella victoriensis.* It may be noted that Pritchard *(P.R.S.Vict.,* vol. 26,

pt. 1, p. 196, 1913) does not regard this species as distinct from *V. maccoyi* Ten.-Woods, but, from what I have seen, several species seem to be lumped under this name.

The genus name *Scaphella* has been indiscriminately applied to many diverse groups of Australian Volutes. Harris *(Cat. Tert. Moll. B.M.*, pt. 1, p. 111) included under this name the Australian *maccoyi*, *polita*, and *ancilloides*, but as he used it also for the New Zealand *Alcithoe*, one cannot trust his grouping. Cossmann *(E.P.C.*, vol. 3, p. 127, 1899) placed *maccoyi*, *victoriensis* (=*polita*), *protorhysa*, and *ellipsoidea* in this genus, using *Alcithoe* for *ancilloides*. The latter may be disposed of at once by stating that it is evidently an *Ericusa*, quite like *fulgetrum* and *sowerbyi*, but with a larger embryo than usual. From the other species mentioned above we may eliminate *ellipsoidea* as foreign to the assemblage, but the remainder—*maccoyi*, *victoriensis*, and *protorhysa*, form a very natural group. *Scaphella*, of course, cannot be used for these, that genus name being applicable to quite a different American group, typified by *Voluta junonia* Hwass (vide Iredale; in Marwick, *T.N.Z.I.*, vol. 56, p. 264, 1926). The apical characters of *junonia* differ considerably from those of *maccoyi*, etc., the nucleus being large, subpointed, inrolled, and strongly granulate; the protoconch in the Australian shells is much smaller, polished all over, only faintly roughened initially, almost flat on top, the tiny early whorls showing distinctly through the glaze. Dall distinctly says *junonia* has no surface polish, while these fossil shells are the most highly glossy of all the austral Volutes. There being no other group at all comparable, I now propose for the three fossil species mentioned, and *Voluta lirata* Johnston *(P.R.S. Tas.* for 1879, p. 37) (united to *maccoyi* by Pritchard, but apparently a distinguishable form, from the specimens I have seen), the new genus *Notopeplum*, naming as type *Scaphella victoriensis* Cossmann. Victorian shells differ somewhat (as Pritchard himself noted) from the Table Cape *maccoyi* and *lirata* in texture, fragility, embryo, and columella, so that possibly two groups (let alone species!) are represented. The true status of Tate's *polita* needs investigation, but I am accepting Pritchard's union of it with the Victorian *maccoyi* auct., not of Ten.-Woods; *i.e.* I have taken *victoriensis* as the name for the common Balcombian form. As the distinction and description of *Notopeplum* is based on the latter, I prefer to nominate *victoriensis* rather than *maccoyi* as type, in spite of this obscurity. Typical *Notopeplum* also occurs with *maccoyi* at Table Cape. A fifth described species and Recent representative exists in *Voluta translucida* Verco, 1896 *(T.R.S.S.A.*, vol. 20, p. 217), described from South Australian waters—where the fossils also lived.

Voluta ringens Noetling, 1901:— **Plejona risor,** n. n
(*Pal. Indica*, N.S., vol. 1, No. 3, p. 323.)

Many of Noetling's species have recently been critically revised by Vredenburg *(Mem. Geol. Surv. India.*, vol. 50, pt. 1, 1925). The above name cannot stand, on account of *Voluta ringens* Turton, 1819 *(Conch. Dict.*, p. 250); the aperture remains unknown, and the generic position is therefore quite doubtful, but *Plejona* is somewhat suggested, so I rename Noetling's shell as above, there being already

a *Plejona noetlingi* (Cossm. and Pissaro, 1909) *(Pal. Indica,* N.S., vol. 3, mem. 1, p. 24).

" **Voluta strombiformis** Johnston."

Cossmann, stating that Deshayes had used this name for a Paris Basin Eocene species renamed the Australian shell *Vespertilio johnstoni* n. n. *(E.P.C.,* vol. 3, p. 119, 1899); and continued this usage in 1909 *(Pal. Indica,* N.S., vol. 3, mem. 1, p. 26), where he says "*A. (ulicina) Johnstoni* Cossm. *(V. strombiformis* Johnston, non Desh.)." No such species was ever described by Johnston; Pritchard, in his revision of the Table Cape Volutes *(P.R.S. Vict.,* vol. 26, pt. 1, pp. 192-201, 1913) makes no mention of such a name or of Cossmann's substitute for it. There is a *Marginella strombiformis* Tenison-Woods, and this was figured by Johnston *(Geol. Tas.,* pl. 31, figs. 4, 4a). If it is to this that Cossmann refers, no comment is needed.

Oliva angustata Tate, 1889:— **Oliva praenominata** Cossmann, 1912. *(T.R.S.S.A.,* vol. 11, p. 144.)

Cossmann states that Marratt used this name in 1870 for a Recent species, and proposes the above substitute *(R.C.P.,* vol. 16, 1912, no. 3, p. 215).

Marginella brevispira Marwick, 1924:—**Marginella marwicki** n. n. *(T.N.Z.I.,* vol. 55, p. 201.)

Cossmann *(E.P.C.,* vol. 3, p. 84, 1899) mentions a *Marginella brevispira* Bellardi, but this is a slip, the name being due to Sacco, 1890 *(I moll. dei. terr. terz. d. Piemont,* etc.); this invalidates Marwick's name which I alter as above. It is also invalidated by *M. (Volvarina) brevispira* Oppenheim, 1906 *(Palaeontographica,* vol. 30, p. 324), for which Tomlin *(Proc. Mal. Soc.,* vol. 13, 1919) has substituted *M. trochiscus.*

Marginella ovata Harris, 1897:—**Marginella harrisi** Cossmann, 1899. *(Cat. Tert. Moll.* B.M., pt. 1, p. 88).

Renamed *Marginella harrisi* in E.P.C., vol. 3, p. 88, though in *R.C.P.,* vol. 3, 1899, no. 4, Index p. 192, it is cited as *Eratoidea harrisi.*

Although this substitute name has become familiar to New Zealand workers, and occurs in many lists, Suter never drew attention to the change or to the reason for it, and the only published note citing the equivalence of the two names seems to be in a list of fossils from Awamoa by Marshall and Uttley *(T.N.Z.I.,* vol. 45, p. 300, 1913).

Pleurotoma clarae Hoernes and Auinger, 1891:—

Clavatula auingeri n. n.

(Gastr. Meeres-Abl. Mio. Medit., etc., lief. 6, p. 320.)

This name is already in use for a well-known Australian Tertiary fossil, *Pleurotoma clarae* Tenison-Woods, 1880 *(P.L.S.N.S.W.,* vol. 4, p. 11).

Pleurotoma coronifer Martin, 1879.

(Tertiars. auf. Java, p. 61.)

Not of Bellardi, 1877 *(Moll. Terz. Piem. e Lig.,* pt. 2, p. 34). The preoccupation has been noticed by Vredenburg *(Mem. Geol. Surv.*

India, vol. 50, pt. 1, p. 54, 1925), but Martin's shell is not renamed as it is referred instead to a north-west Indian fossil described by Vredenburg as *Pleurotoma (Gemmula) congener* E. A. Smith var. *mekranica* nov.

Turris neglectus Suter, 1917:— **Gemmula insensa** (Finlay, 1924)
(N.Z. Geol. Surv. Pal. Bull., No. 5, p. 46, 1917.)

I renamed this species *(Proc. Mal. Soc.,* vol. 16, pt 2, p. 103, 1924) *Turris insensus* on account of the earlier *Pleurotoma neglecta* Reeve, 1842. It could probably be successfully argued that modern classification would not leave these shells in the same genus, and that the names therefore do not interfere. However, the existence of a *Turris neglectus* Lesson, 1837 *(Prodr.,* No. 38, and *Hist. Nat. des Acad.,* p. 284, 1843) renders debate unnecessary. Lesson's *Turris* was not a gasteropod but a hydroid.

Pleurotoma laevis Bell, 1890:— **Raphitoma belliana** n. n.
(Rep. Brit. Assoc., Leeds, p. 410.)

This Crag species has been recorded by Harmer *(M.P.S.,* vol. 72, p. 523), but the name had already been used by Hutton for a New Zealand Recent species *(Cat. Marine Moll.,* p. 12, 1873). Both these propositions will upset *Pleurotoma selwyni* var. *laevis* Pritchard, 1904 *(P.R.S. Victoria,* vol. 17, N.S., p. 328) which may therefore be renamed *Epideira selwyni suppressa* n. n.

Turris reticulatus Marshall, 1919.
(T.N.Z.I., vol. 51, p. 231.)

The trivial description "reticulate" has been frequently used for Turrids. Brown, 1827 (*Illust. Conch. G.B.,* ed. 1, p. 8) proposed a *Pleurotoma reticulata* which will invalidate Philippi's proposal in 1844 of the same name for a Sicilian fossil (*Enum. Moll. Sicil.,* vol. 2, p. 165); Harmer has noted the latter species from the English Crag *(M.P.S.,* vol. 68, p. 239), but another name must be used. *Pleurotoma reticulata* Garrett, 1857 *(Proc. Cal. Acad.,* vol. 1, p. 102) is stated by Tryon (*Man. Conch.,* vol. VI., p. 298, 184) to be a synonym of *P. pumila* Mighels. All these names will interfere with *Pleurotoma (Drillia) reticulata* Tesch, 1915 *(Pal. Timor,* vol. 5, p. 32), which may therefore be renamed *Melatoma teschi* n. n.—and this in turn will invalidate *Drillia reticulata* Vredenburg, 1921 *(Rec. Geol. Surv. India,* vol. 53, p. 111), for which I now substitute *Inquisitor vredenburgi* n. n. Not one of these names is strictly homonymous with *Turris reticulatus* Marshall, proposed for a Hampden fossil; it is a *Gemmula,* and as none of the forms mentioned can be included in this genus, Marshall's name must be allowed to stand.

Pleurotoma sulcata Hutton, 1873:—
Austrotoma suteri (Cossmann, 1916).
(Cat. Tert. Moll., p. 4.)

I have already drawn attention *(T.N.Z.I.,* vol. 55, p. 515, 1924) to the fact that when I renamed this species *(Proc. Mal. Soc.,* vol. 16, pt. 2, p. 104, 1924) *Pseudotoma huttoni,* I had been anticipated by Cossmann, who for the same reason (the prior *P. sulcata* Lamk.) proposed *Bathytoma suteri* n. n. *(R.C.P.,* vol. 20, 1916, No. 1, p. 9).

For this and other New Zealand species I have proposed the group name *Austrotoma,* with *Bathytoma excavata* Suter as type *(T.N.Z.I.,* vol. 55, p. 515, 1924).

Pleurotoma optata Smith, 1899:— **Gemmula indagatoris** n. n.
(Ann. Mag. Nat. Hist., ser. 7, vol. 4, p. 238.)

Figured by Alcock and McArdle in 1901 *("Investigator" Illustrations, Mollusca,* pt. 3, pl. 9, figs. 1, 1a). The specific name had been used two years previously by Harris *(Cat. Tert. Moll. B. M.,* pt. 1, p. 44, 1897) for an Australian fossil.

Surcula obliquecostata Suter, 1917.
(N.Z. Geol. Surv. Pal. Bull. No. 5, p. 52.)

Invalidated by *Pleurotoma (Surcula) obliquicostata* Martens, 1901 *(Ges. naturf. Berlin,* p. 16). No new name is imposed, as Suter's shell is evidently a synonym of his previously described *Pleurotoma pareoraensis (Proc. Mal. Soc. Lond.,* vol. 7, p. 208, 1907), from the same locality, the latter being described from a senile abraded specimen, and the former from a clean juvenile.

Drillia laevis parva Suter, 1908:— **Splendrillia debilis** n. n.
(Proc. Mal. Soc., vol. 8, p. 185.)

Pleurotoma (Drillia) parva Tokunaga, 1906 *(Tokyo J. Coll. Sci.,* vol. 21, p. 16) makes necessary this renomination. I also rename Tokunaga's shell *Inquisitor (?) tokunagae* n. n. as there is a prior *Pleurotoma (Drillia) parva* Smith, 1888 *(A.M.N.H.,* ser. 6, vol. 2, p. 303), which, in turn, has been renamed by Dall *(Proc. U.S. Nat. Mus.,* vol. 54, p. 333, 1919) on account of Conrad's use of the name in 1830.

Bela robusta Hutton, 1877:— **Austrotoma minor** Finlay, 1924.
(T.N.Z.I., vol. 9, p. 595.)

Not of Packard, 1869 *(Mem. Bost. Soc. Nat. Hist.,* p. 232). Renamed in *T.N.Z.I.,* vol. 55, p. 515, footnote, 1924.

Conus affinis Martin, 1879:— **Conus sannio** n. n.
(Die Tertiars. auf Java, p. 15.)

Not of Gmelin, 1791 (in *Linn. Syst. Nat.,* ed. 13, 1, p. 3391).

Conus australis Lamk., 1810.
(Ann. Mus. H. N. Paris, vol. 15, p. 439.)

Hedley *(Ind. Moll. West Austr.,* p. 56, 1916), following E. A. Smith, has recorded *Conus australis* Chemnitz, 1795 from West Australia. Chemnitz's names, however, are now rejected, so that *Conus australis* must date from 1810, being first legally introduced by Lamarck at the reference above quoted. And this will necessitate its rejection for seven years previously Schroeter *(Archiv. Zool.* (Wiedemann), vol. 3, pt. 2, p. 71, 1803) had employed the same combination. Smith *(Ann. Mag. Nat. Hist.,* ser. 6, vol. 14, p. 158, 1894) cites *Conus gracilis, duplicatus,* and *laterculus,* all of Sowerby, as synonyms of this species, so several names are available to fill the vacancy, and I leave the selection of the correct one to local workers who know the actual shells.

Conus convexus Marshall, 1918:— **Conospira thorae** n. n.
(T.N.Z.I., vol. 50, p. 270.)

Not of Harris, 1897 *(Cat. Tert. Moll. B.M.*, pt. 1, p. 31), for an Australian Tertiary shell, referred to *Leptoconus,* and reduced by Tate *(P.R.S.N.S.W.*, vol. 31, p. 382, 1897) to a synonym of his *Conus (Leptoconus) acrotholoides (T.R.S.S.A.*, vol. 13, p. 199, 1890); from my own specimens this seems fully justified.

Conus deperditus Suter, 1917:— **Conospira suteri** (Cossmann, 1918).
(N.Z. Geol. Surv. Pal. Bull. No. 5, p. 61.)

When I altered this to *Conospira fracta* n. n. *(Proc. Mal. Soc. Lond.*, vol. 16, pt. 2, p. 105, 1924) on account of preoccupation by Bruguiere (*Encycl. Meth.*, p. 691, 1798), I was unaware that in the *Rev. Crit. de Palézool.* (1918, No. 4, p. 113) Cossmann had already renamed the New Zealand shell *Conus suteri,* on account of prior use of the name *deperditus* by Lamarck *(Ann. Mus.*, vol. 1, p. 387, 1802) who, however, is referring to Bruguiere's shell, and not to a new species. *Conospira suteri* (Cossmann, 1918) will thus supplant *C. fracta* Finlay, 1924.

Conus fasciatus Martin, 1884:— **Leptoconus jocus** n. n.
(S.G.R.M.L., Ser. 1, Bd. 3, p. 50.)

Vredenburg has recently reported this as a fossil from north-west India *(Mem. Geol. Surv. India,* vol. 50, pt. 1, p. 74, 1925), but the name had been proposed for several different species of *Conus* before Martin thought of it. Tryon *(Man. Conch.*, vol. 6, pp. 32, 51) places Kiener's *Conus fasciatus,* 1848 *(Coq. Viv.*, p. 311) under *C. lignarius* Reeve, and A. Adams' shell of the same name *(Proc. Zool. Soc.*, 1853, p. 119) as a synonym of *C. bifasciatus* Sow., but both these proposals are antedated by *Conus fasciatus* Meuschen, 1787 *(Mus. Gevers.*, p. 354).

Conus (Leptoconus) lyratus Marshall, 1918:—
Conospira marshalli n. n.
(T.N.Z.I., vol. 50, p. 270.)

Not *Conus liratus* Reeve, 1843 *(Proc. Zool. Soc.*, 1843, p. 181; and *Conch. Icon.*, vol. 1,—*Conus* no. 268). It is questionable whether this species is really distinct from *C. armoricus* Suter *(N.Z. Geol. Surv. Pal. Bul. No. 5,* p. 61, 1917), described from the same locality, but as Marshall records both species, neither of which I have seen, I leave them as distinct.

Conus ornatus Hutton, 1873:— **Conospira huttoni** (Tate, 1890).
(Cat. Tert. Moll., p. 10.)

I have dealt with this elsewhere *(Proc. Mal. Soc. Lond.*, vol. 16, pt. 2, p. 105), showing that *ornatus* Hutt.=*trailli* Hutt., and that both names were preoccupied. My substitute *Conospira bimutata,* however, must fall before *C. huttoni* Tate, proposed amongst some remarks on an Australian Tertiary species for *C. trailli* Hutt., *non* Adams. The full synonymy stands as follows:—

Conospira huttoni (Tate, 1890).

1873. *Conus ornatus* and *C. trailli* Hutton, *Cat. Tert. Moll.*, p. 10.
1890. "*C(onus) huttoni, mihi (C. Trailli* Hutton, non Adams)"; Tate, *T.R.S.S.A.*, vol. 13, pt. 2, p. 198.
1914. *Conus (Conospira) ornatus* Hutt., and *Hemiconus trailli* Hutt.; Suter, *N.Z. Geol. Surv. Pal. Bull. No. 2*; p. 31.
1917. *Hemiconus ornatus* (Hutt.): Suter, *N.Z. Geol. Surv. Pal. Bull. No. 5*, p. 84.
1924a. *Hemiconus trailli* (Hutt.): Finlay, *Proc. Mal. Soc.*, vol. 16, pt. 2, p. 105.
1924b. *Cenospira* (sic) *bimutata* nom. nov. for *Conus trailli* Hutt., non A. Adams: Finlay, *T.N.Z.I.*, vol. 51, p. 498, footnote. (Error type for *Conospira*).
1926. *Conospira bimutata* Finlay; *T.N.Z.I.*, vol. 56, p. 255.
1927. *Conospira huttoni* (Tate, 1890): Finlay, *T.N.Z.I.*, vol. 57, p. 518.

Conus ornatus Maury, 1919 *(Bull. Amer. Pal.*, vol. 5, p. 206), invalidated by both Hutton's and Michelotti's names, may take the new name *Conus mauryi* n. n.

Conus parvus Pease, 1868:— **Lovellona peaseana** n. n.
(Am. Journ. Conch., vol. 4, p. 126.)

Pease proposed this as a new name for *Conus fusiformis* Pease, 1860 preoccupied, and Iredale has compared the species with Hedley's *Conus micarius (Rec. Austr. Mus.*, vol. 8, p. 147, 1912), described from Queensland, noting that both species belong to his new genus *Lovellona (Proc. Mal. Soc. Lond.*, vol. 12, pt. 6, p. 329, 1917) proposed for *Conus atramentosus* Reeve. As the specific name cannot be maintained, on account of *Conus parvus* Lea, 1833 *(Contrib. to Geol. Alabama)* I rename the species as above.

Terebra bicincta Martin, 1879:— **Terebra martini** Vredenburg, 1925.
(Die Tertiars. auf Java, p. 33.)

Not of Hinds, 1844 *(Proc. Zool. Soc.*, vol. 11, pt. 130, p. 150). Noetling *(Pal. Indica*, N.S., vol. 1, No. 3, p. 337, 1901) has used Martin's name for an Indian fossil, but Vredenburg *(Mem. Geol. Surv. India*, vol. 50, pt. 1, p. 24, footnote, 1925) in revising some of his identifications, has noted the preoccupation and renamed the Javan species *Terebra martini*.

Terebra costata Hutton, 1885.
(T.N.Z.I., vol. 17, p. 315.)

Borson in 1823, and Lea ten years later *(Contrib. to Geol. Alabama*, p. 166, 1833) have both used this name. It does not seem wise, however, to rename Hutton's species at present; it appears inseparable from the Recent *T. tristis* Deshayes, and Hutton's name may be dropped in the meantime, final judgment being suspended till the New Zealand Terebridae are revised as a group.

The names of Hutton, Lea, and Borson, however, are all effective in disposing of two varietal names given to Crag Terebras by Harmer; *Terebra canalis* var. *costata (M.P.S.*, vol. 68, p. 53) which Harmer says is characteristic of the Belgian Crag, I rename *T. canalis wouveri* n. n., while for *Terebra inversa* var. *costata (l.c.*, p. 54) I propose *T. inversa oakleyana* n. n.

Terebra simplex Tenison-Woods, 1876:— **Terebra tenisoni** n. n.
(*P.R.S.Tas.* for 1875, p. 21.)

This combination has been used many times. Tenison-Woods proposed it for a Table Cape fossil, and Tate (*T.R.S.S.A.*, vol. 11, p. 162, 1888) adopted the name, with the remark, "The specific name given to this fossil is preoccupied by a Californian shell described by P. Carpenter; but as that 'is very probably a minor variety of *T. variegata* (Gray),' Tryon, there is no need to apply a new designation." This is, of course, illegal, and as May (*P.R.S.Tas.*, 1918, p. 113) and Iredale (*Rec. Austr. Mus.*, vol. 14, no. 4, p. 268, 1925) have continued the usage, I now rename the Table Cape fossil as above. Carpenter proposed his name in 1865 (*Ann. Mag. Nat. Hist.*, ser. 3, vol. 15, p. 394), but he in turn was anticipated by Conrad, who used this name in 1830 for a Miocene fossil from Maryland; Dall has lately called attention to this, and renamed the Recent shell (*U.S. Nat. Mus. Bull. 112*, p. 67, 1921). Still another user of this name is Roth v. Telegd (*Geol. Hung.*, vol. 1, p. 33, 1914); for his shell the name *Terebra telegdi* n. n. may be substituted.

Pupa affinis (A. Adams, 1855) (*Solidula).*
(*Proc. Zool. Soc.*, 1854, p. 61.)

There are two previous proposers of the name *Pupa affinis*, viz., Rossmaessler, 1839 (*Incones L. u. S. Mol. Europ.*, vol. 2, pts. 3 and 4, p. 26), and Aradas and Maggiore, 1843 (*Atti. Acc. Gioenia*, vol. 17, p. 88), but, as their *Pupa* was not the Boltenian one, and the names are not homonyms, Adams's name is not affected by these.

Cossmann (*R.C.P.*, 1902, No. 3, p. 160) has, however, provided the substitute *Actaeon pilsbryi*, on the plea of preoccupation of Adams's name by Sowerby, 1836. But Sowerby's shell was described as a *Tornatella* (*Trans. Geol. Soc. Lond.*, vol. 2, pt. 4, p. 343, 1836), and was only referred to *Actaeon* by d'Orbigny (*Pal. Franc. Cret.*, vol. 2, *Gastr.*, p. 117, 1843); it does not clash with *Pupa* or *Solidula*, and Adams's name must stand, Cossmann's being relegated to synonymy. It may be noted that Cosssmann, apparently overlooking his earlier action, decided later, when noting four users of the term *Actaeon affinis* (*R.C.P.*, 1920, No. 2, p. 82), that caution was preferable, and that Adams's shell and *A. affinis* Muller should not be renamed till their synonymy had been investigated. Second thoughts seem to have been better in this case.

Retusa decapitata (Suter, 1909) (*Tornatina*):— **Retusa suteri** n. n.
(*Proc. Mal. Soc. Lond.*, vol. 8, p. 256.)

Not *Retusa decapitata* Dall, 1896 (*Proc. U.S. Nat. Mus.*, vol. 15, p. 30).

Tornatina voluta (Q. & G., 1833) (*Bulla*):— **Retusa gaimardi** n. n.
(*Voy. Astrol.*, vol. 2, p. 359.)

Not *Bulla voluta* Gmelin, 1791 (*Linn. Syst. Nat.*, ed. 13, pt. 1, p. 3433).

Haminoea ambigua (A. Adams, 1850) (*Bulla*):— **Haminoea arthuri** n. n.
(*Thes. Conch.*, vol. 2, p. 582.)

This species, described from New Ireland, is included in Hedley's West Australian list (1916, p. 72), but there are two previous pro-

posals of *Bulla ambigua,* viz., Gmelin, 1791 *(Linn. Syst. Nat.,* ed. 13, p. 3431), and d'Orbigny, 1842 *(Amer. Merid., Pal.,* p. 113).

Atys elongata (A. Adams, 1850) *(Bulla)*:— **Atys extensa** n. n.
(Thes. Conch., vol. 2, p. 587.)

A parallel case to the preceding; the prior *Bulla elongata* being of Phillips, 1835 *(Illust. Geol. Yorkshire,* pt. 1, p. 102).

Succinea aperta Cox, 1868:— **Succinea coxi** n. n.
(Monog. Austr. Land Shells, p. 90.)

Not of Lea, 1838 *(Trans. Amer. Phil. Soc.,* N.S., vol. 6, pt. 1, p. 101).

Dentalium huttoni Bather, 1905:— **Dentalium batheri** n. n.
(Geol. Mag., dec. 5, vol. 2, p. 532.)

This name has already been used by T. W. Kirk, 1880 *(T.N.Z.I.,* vol. 12, p. 306) for a New Zealand Recent shell.

Dentalium solidum Hutton, 1873.
(Cat. Tert. Moll., p. 2.)

In *N.Z. Geol. Surv. Pal. Bull. No. 8,* p. 3, footnote, 1922, it is noted that there is also a *Dentalium solidum* Verrill, the date of publication of which was unknown to the writers. It dates from 1884 *(Trans. Conn. Acad.,* vol. 6, p. 215), and so is invalidated by Hutton's name, but as Dall *(Bull. Mus. Comp. Zool.,* vol. 12, no. 6, p. 422, 1886) has indicated that it is a synonym of *D. candidum* Jeffreys, no change need be made.

Cadulus compressus (Martin, 1886) *(Dentalium)*:—
Cadulus martini n. n.
(S.G.R.M.L., ser. 1, bd. 3, p. 189.)

Not *Dentalium compressum* Watson, 1879 *(Journ. Linn. Soc.,* vol. 14, p. 516), nor of d'Orbigny, 1850 *(Prodr. Paleont.,* vol. 1, p. 233).

Cadulus laevis (Brazier, 1877) *(Dentalium)*:—
Cadulus brazieri n. n.
(P.L.S.N.S.W., vol. 2, p. 59.)

Not *Dentalium laeve* Turton, 1819 *(Conch Dict.,* p. 256), nor *D. laevis* Schlotheim, 1820 *(Die Petrefackten),* nor *D. laevis* Hutton, 1873 *(Cat. Tert. Moll,* p. 2), which Pilsbry and Sharp *(Man. Conch.,* vol. 17, p. 211, 1897) have renamed *D. pareoraensis.* Brazier's shell was described as *Dentalium laeve* from North Australia, and appears in Hedley's Queensland list (1909, p. 371).

Nucula arcaeformis Chapman, 1908:—
Nucula chapmani Cossmann, 1920.
(Mem. Nat. Mus., No. 2, p. 30.)

Renamed by Cossmann *(R.C.P.,* 1920, No. 1, p. 38) on account of prior use of the name by Philippi, 1887, for a Cretaceous Chilian shell.

Nucula acuta Sowerby, 1840.
(Trans. Geol. Soc. Lond., vol. 2, pt. 5, pl. 39.)

This English Cretaceous species is mentioned merely to note that both Wood *(M.P.S.,* vol. 58, p. 167) and Wheelton Hind *(id.* vol. 51,

p. 208) have retained Sowerby's name, though Conrad used the name eight years before Sowerby *(Amer. Mar. Conch.*, vol. 3, p. 32, 1832) for a well-known American Recent species. Both are now referred to *Nuculana,* so the homonymity is exact. Neither of the writers mentioned quote any synonyms of Sowerby's species, and if none can be found a new name will have to be imposed.

Nucula simplex A. Adams, 1856.

(Proc. Zool. Soc., 1856, p. 52.)

Hedley *(P.L.S.N.S.W.*, vol. 38, pt. 2, p. 263, 1913) once concluded that *simplex, strangei* A.Ad., and *antipodum* Hanley were synonyms, and that the first named should be used on the score of priority. Long ago, however, Stolickza *(Pal Indica,* vol. 3, p. 326, 1871), when recording a *Nucula simplex* Deshayes, 1842 *(Mem. Soc. Geol. de France,* vol. 5, p. 7), wrote, "Non *simplex* A.Ad., 1856, a recent shell, the name of which must be changed." However, this does not now seem necessary, for *N. obliqua* Lamk. is now used as the earliest name for the Australian shell, and there are plenty of synonyms—*antipodum* Hanley, 1860, *tumida* Ten-Woods, 1877 *(non* Hinds, *nec* Philippi), *grayi* Ten.-Woods, 1877, *dilecta* Smith, 1891, and *tenisoni* Pritchard, 1896; though some of these are for fossils, which may later prove trinomially separable. The New Zealand *N. strangei* A.Ad. is now regarded as distinct from the Australian shells.

Nucula truncata Moore, 1870.

(Quart. Journ. Geol. Soc., vol. 26, p. 254.)

This combination has been even more favoured than *Terebra simplex.* Brown proposed the name in 1827 *(Ill. Conch. Gt. Brit.*, pl. 25, f. 19) and Searles Wood has used his name as *Leda truncata* (Brown) *(Mon. Crag Moll.* p. 94, 1848) while Dall *(Proc. Cal. Acad. Sci.*, 1874) refers to it as *Yoldia truncata.* Nilsson, however, in the same year also proposed a *Nucula truncata (Petref. Suec.*, p. 16, 1827); I do not know which has priority. Gabb then used the name in 1864 *(Pal. Calif.*, vol. 1, p. 198); his shell is referable to *Acila,* and as such is recorded, e.g., by Packard *(Bull. Dept. Geol. Univ. Cal.* vol. 9, no. 12, 1916); I now rename it *Acila demessa* n. n. Then comes Moore's name, as given above; Etheridge jr. *(Mem. Roy. Soc. S.A.*, vol. 2, pt. 1, p. 24) records both this species and *N. cooperi* Moore *(Quart. Journ. Geol. Soc.*, vol. 26, p. 254, 1870) from the Cretaceous of the Lake Eyre Basin, but expresses doubt as to their distinction, saying, "The brevity of Moore's descriptions has rendered it almost impossible to recognise some of his species, this amongst the number"; as the name *truncata* cannot be maintained, it may therefore be dropped altogether in the meantime, and *N. cooperi* Moore used to cover all such forms, pending future decision on the distinctness of his species. The last user of the name seems to be Muller, 1898 for a species from the lower Senonian of Brunswick; this was renamed *N. mulleri* by Cossmann *(R.C.P.*, vol. 7, 1903, No. 3, p. 142) on account of Moore's use.

Nuculana alata (Martin, 1887) *(Crassatella)*:— **Nuculana martini** n. n.
(S.G.R.M.L., Bd. 3, p. 228.)

Not *Nuculana alata* Muller 1859 *(Petref. Aach. Kreidef., Supplem.*, p. 28).

Leda apiculata Tate, 1886:— **Nuculana chapmani** Finlay, 1924.
(T.R.S.S.A., vol. 8, p. 131.)

On the ground of preoccupation by *Nucula apiculata* J. de C. Sow., I renamed this *Nuculana chapmani (Proc. Mal. Soc. Lond.*, vol. 16, pt. 2, p. 107). Some modern writers retain Sowerby's shell in *Nucula*, but there is also a *Nucula apiculata* Reuss, 1844 *(Geogn. Skizz Boehmen*, vol. 2, p. 191), which is allowed to be a *Nuculana*. Dennant and Kitson *(Rec. Geol. Surv. Vict.*, vol. 1, pt. 2, p. 122, 1903) state that *Leda acuticauda* Pritchard, described from the Balcombian clays of Mornington, is probably a synonym of *L. apiculata* Tate, in which case this name would claim preference. But Pritchard amply distinguished his shell from Tate's at the time of description, and from examination of my own specimens, I can affirm that the two are very distinct, *apiculata* being larger, with different shape, and much coarser ornament. It must bear my name *chapmani*, and as Tate gave several localities, but designated none as typical, and as the species has therefore been given an extensive and quite erroneous range by later writers, I now nominate the *Turritella*-clays of the lower Aldinga beds (Aldingan stage—Eocene) as type locality. *N. chapmani* does not occur at Balcombe Bay (nor probably in the Balcombian at all), being represented by *N. acuticauda* Pritch. and a variety of it.

Malletia elongata Marshall, 1917.
(T.N.Z.I., vol. 49, p. 458.)

Etheridge jr. *(Mem. Roy. Soc. S.A.*, vol. 2, pt. 1, p. 26, 1902) has referred *Leda elongata* Etheridge senr. to *Malletia*, and this would clash with Marshall's name; but fortunately we are able to conserve the latter, as Nuculanas had been described before under the name *elongata*. Sowerby's *Nucula elongata (Proc. Zool. Soc.*, 1832, p. 197) is the type of the group *Adrana*, while Dandin and Valenciennes both described Nuculanas under the name *Nucula elongata.* Etheridge has noted Sowerby's use *(Geol. Surv. Qnsld. Bull. 13*, p. 26, 1901), but proposed no new name; this was fortunate, since he decided later that his *Nuculana (? Yoldia) randsi (Geol. Pal. Qnsld.*, etc., p. 566, 1892) was a synonym. *Neilo randsi* (Eth. fil.) will therefore become the correct name for the Australian Cretaceous fossil, leaving *Neilo elongata* (Marshall) secure; the reference of both species to *Neilo* A. Ad., rather than to *Malletia* Desmoulins seems necessary *(vide* Marwick, *Trans. N.Z. Inst.*, vol. 56, p. 329, 1926).

Anomia undata Hutton, 1885.
(T.N.Z.I., vol. 17, p. 324.)

The name *Anomia undata* also appears in Brown's *Illust. Rec. Conch. Gt. Brit.*, 2nd edit., p. 267; expl. to Pl. 59, f. 14, but as it is obviously a misprint for the well known *Anomia undulata* of Gmelin, 1791, it can hardly be regarded as upsetting Hutton's later name.

Arca clathrata Reeve, 1844.
(*Conch. Icon.*, vol. 2—*Arca* No. 48.)

Noetling (*Pal. Indica.* N.S., vol. 1, No. 3, p. 134, footnote, 1901) has already pointed out that Reeve's name is antedated by *Arca clathrata* Defrance, 1816 (*Dict. Sci. Nat.*, ed. 2, vol. 2, Suppl., p. 115), so that another name must be sought, but as the Philippine species is a doubtful one, the matter may be left over. Lamarck also described an *Arca* under this name (*Anim. s. Vert.*, vol. 6, pt. 1, p. 46, 1819), which writers have referred to Defrance's species. *Byssoarca clathrata* M'Coy, 1844 (*Syn. Carb. Foss. Ireland,* p. 73) is an unsatisfactory form; Hind (*M.P.S.*, vol. 51, p. 153, 1897) states that the type is lost, and the species probably a synonym of *Parallellodon reticulatus* (M'Coy). One other user of the name is Leckenby, 1858 (*Quart. Journ. Geol. Soc.*, vol. 15, p. 15), but his *Arca clathrata* is stated (*Ann. de Pal.*, Tome 8, fasc. 2, p. 153, 1913) to be practically identical with *Arca euryta* d'Orb. (*Prod. Pal.*, no. 272, p. 311).

Cucullaea minuta Johnston, 1880.
(*P.R.S.Tas.* for 1879, p. 40.)

Tate, when describing *Limea transenna* (*T.R.S.S.A.*, vol. 8, p. 119, 1886) placed Johnston's shell doubtfully as equivalent. Were this so, Johnston's name should claim usage, but there is considerable diversity of opinion as to what this unfigured Table Cape shell really is. Iredale (*P.L.S.N.S.W.*, vol. 49, pt. 3, p. 186, 1924) refers to it when treating of *Bathyarca,* but decides that it looks more like a *Limopsis,* and this seems the most reasonable interpretation of the diagnosis. May, however, when criticising the Johnston types (*P.R.S.Tas.*, 1918, p. 73), wrote of this form, "Type crushed; probably a young shell. I advise its abandonment also." Fortunately we are relieved from argument on this point, as there is an item that will dispose of the whole matter, and that is the proposition of a *Cucullaea minuta* Sowerby long anterior to Johnston's (*Min. Conch.*, vol. 5, p. 68, 1824).

Pectunculus globosus Hutton, 1873:—
Glycimeris huttoni Marwick, 1923.
(*Cat. Tert. Moll.*, p. 28.)

Not of J. de C. Sowerby, 1850 (in Dixon's *Geol. Sussex,* p. 170); renamed by Marwick (*T.N.Z.I.*, vol. 55, p. 68, 1923).

Glycimeris halli var. **intermedia** Pritchard, 1903:—
G. halli mistio n. n.
(*P.R.S. Vict.*, vol. 15, N.S., pt. 2, p. 90.)

Chapman and Singleton (*P.R.S. Vict.*, vol. 37, N.S. pt. 1, p. 41, 1925) have lately recorded this form in their revision of the Australian fossil species, but there is a prior *Pectunculus intermedius* Broderip, 1832 (*Proc. Zool. Soc.*, 1832, p. 126). Both are true *Glycimeris,* i.e., have obscurely-defined primary ribs over-run by numerous well-developed secondary striations, a subovate form, narrow hinge-line, etc., so Pritchard's varietal name needs alteration.

Axinaea orbicularis Martin, 1887:— **Glycimeris martini** n. n.
(S.G.R.M.L., ser. 1, Bd. 3, p. 234.)

This again is a true *Glycimeris,* and the name is therefore invalidated by *Glycimeris orbicularis* Da Costa, 1778 *(Brit. Conch.,* p. 168). Had Martin's species belonged to the group having broad, strong, non-striated ribs, his specific name would still have had to be rejected, as *Pectunculus orbicularis* Angas, 1879 *(Proc. Zool. Soc. Lond.,* 1879, p. 420) is a member of this series; Australian writers regard it as a synonym of *P. flabellatus* Ten.-Woods, the latest to do so being Iredale *(P.L.S.N.S.W.,* vol. 49, pt. 3, p. 189, 1924).

A nomenclatural decision given on an English Cretaceous species must be reversed. Woods *(M.P.S.* vol. 53, p. 55, 1899) placed *Pectunculus obliquus* Keeping, 1883 *(Foss. etc., Neoc. Upware & Brickhill,* p. 116) in *Cucullaea (Dicranodonta),* with the remark, "The specific name given by Keeping is preoccupied as shown above, but since the species is now removed from *Pectunculus,* the specific name can be retained." This is against present-day rules, and as Woods indicates no synonyms, Keeping's shell may be renamed *Cucullaea keepingi* n. n. His specific name had been proposed at least four times before he used it, viz., Defrance, 1826 *(Dict. Sci. Nat.,* vol. 39, p. 224); Lea, 1833 *(Contrib. to Geol.,* p. 78); Munster, 1835 *(Neue Jahrb fur Min.,* etc., p. 438); and Reeve, 1843 *(Conch. Icon.,* vol. 1—*Pectunculus* No. 33), the last species being now considered a synonym of *G. striatularis* Lamk.

Exactly the same remarks apply to *Cucullaea obesa* (Pictet & Roux) 1852 *(Arca),* which Woods *(l.c.,* p. 61) records without synonyms, though preoccupied by *Arca obesa* Sow., 1833.

Mytilus inflatus Moore, 1870:—
Mytilus linguloides Huddleston, 1884.
(Quart. Journ. Geol. Soc., vol. 26, p. 252.)

Not *M. inflatus* Muller, 1849 *(Amt. Ber. Vers. deutsch Nat. u. Aerzte* for 1847). Jack and Etheridge jr. *(Geol. Pal. Qnsld & N. Guinea,* p. 467, 1892) remark that, "The specific name of this species was preoccupied by Muller before it was made use of by Mr. Moore, but the species described by the former is referable to another pre-existing species, wherefore the name ascribed by Mr. Moore to the Australian shell will probably stand." This is, of course, contrary to present rules, and Cossmann has accordingly renamed Moore's species *M. moorei* n. n. *(R.C.P.,* vol. 11, 1907, no. 3, p. 201). Etheridge jr., however, had already stated *(Mem. Roy. Soc. S.A.,* vol. 2, pt. 1, p. 18, 1902) that *Modiola linguloides* Huddleston, 1884 *(Geol. Mag.,* no. 1, pt. 3, p. 341) was a synonym, and as this course has been generally followed by Australian writers, Huddleston's name should come into use, Cossmann's being unnecessary.

Musculus elongatus (Hutton, 1873) *(Crenella).*
(Cat. Tert. Moll., p. 25.)

This proposal will invalidate *Crenella elongata* Stanton, 1920 *(U.S. Geol. Surv., Prof. Pap. no. 128* p. 25), which may therefore take the new name *Crenella stantoni* n. n.

Genus **Pachydomella** Etheridge fils., 1907 :— Genus **Barcoona** n. n.
(Rec. Austr. Mus., vol. 6, no. 5, p. 325.)

Proposed for an edentulous Queensland bivalve, the type and sole species being *P. chutus* n. sp. The name is preoccupied by Ulrich, 1891 for a Silurian Ostrocod *(Journ. Cincinn. Soc.*, vol. 13, p. 198), so I rename the Australian genus as above (from the Barcoo River, the approximate locality).

Pecten costato-striatus Marshall, 1918.
(T.N.Z.I., vol. 50, p. 273.)

Not to be confounded with *Pecten striato-costatus* Goldfuss, 1833 *(Petref. Germ.*, vol. 2, p. 55).

Pecten deformis Tate, 1887 :— **Hinnites tatei** Cossmann, 1907.
(T.R.S.S.A., vol. 9, p. 185.)

Stating that Gabb had used this name in 1864, Cossmann *(R.C.P.* vol. 11, 1907, no. 3, p. 201) renamed Tate's shell as above. This makes three described species of *Hinnites* from the Australian Tertiaries, viz., *H. corioensis* McCoy, 1879 *(Prod. Pal. Vict.*, Dec. 6, pl. 58), from Corio Bay (Janjukian); the present species, from the Upper Beds of Muddy Creek (Kalimnan); and *H. mulderi* Chapman, 1922 *(P.R.S. Vict.*, vol. 35, N.S., pt. 1, p. 5), from the Batesford limestone (Janjukian).

Pecten (Camptonectes) hectori Woods, 1917 :—
Camptonectes selwynensis n. n.
(N.Z. Geol. Surv. Pal. Bull., No. 4, p. 26.)

Woods was forestalled in his compliment to Sir James Hector by Hutton, who had already proposed a *Pecten hectori* in 1873 *(Cat. Tert. Moll.*, p. 30). His shell was identified by Suter as *Pecten yahlensis* Ten.-Woods, but Marwick *(Rep. Austr. Ass. Adv. Sci.*, vol. 16, p. 326, 1924), in dissenting from this conclusion, has revived Hutton's name, noting that the species is apparently restricted to the Chatham Islands.

Pecten pulchellus Reeve, 1853 :— **Chlamys moretonicus** n. n.
(Conch. Icon. vol. 8—*Pecten* no. 142.)

Described from Moreton Bay, Australia, and included by Hedley in his Queensland list (1909, p. 345). The specific name, however, had been previously used by Nilsson in 1827 *(Petref. Suecana,* p. 22).

Pecten sectus Hutton, 1873 :— **Pecten wollastoni** n. n.
(Cat. Tert. Moll., p. 30.)

Not of Goldfuss, 1836 *(Petref. Germ,* vol. 2, lief. 5).

Pecten semiplicatus Hutton, 1873 :— **Pallium mariae** n. n.
(Cat. Tert. Moll., p. 30.)

Not of Alth, in Favre, 1869 *(Moll. foss. de Lemberg,* p. 150).

Pecten undulatus Sowerby, 1842:— **Chlamys anguineus** n. n.
(*Thes. Conch.*, vol. 1, *Pecten*, p. 60.)

Iredale has recently added this species to the New South Wales fauna from a valve dredged at Twofold Bay, and recorded its distinctness from *tasmanicus* Ang. The trivial name must be altered, however, as there is a prior *Pecten undulatus* Nilsson, 1827 (*Petref. Suecana*, p. 21), which name was later used by d'Orbigny, 1845 (in Murchison, *de Vern. de Keys. Geol. Russ. d'Europe*, vol. 2, p. 490) for a shell now placed by Woods (*M.P.S.*, vol. 56, p. 175, 1902) as a synonym of *Chlamys cretosus* Defr., 1822. McCoy's *Pecten undulatus* (*Synops. Carb. Foss. Ireland*, p. 101, 1844) is regarded by Wheelton Hind (*M.P.S.*, vol. 57, p. 70, 1903) as a doubtful synonym of *Aviculopecten dissimilis* Fleming, 1828.

Pecten zitteli Hutton, 1873.
(*Cat. Tert. Moll.*, p. 32.)

This invalidates *P. zitteli* Woehrmann and Koken, 1892 (*Z. geol. Ges.*, vol. 44, p. 173), which may be renamed *Pecten schlernica* n. n.

Plicatula imbricata Menke, 1843:— **Plicatula menkeana** n. n.
(*Moll. Nov. Holl.*, p. 35.)

This species is recorded from the Tertiaries of Java by Martin (*Pal. Kennt. von Java*, p. 57, 1919) and from Queensland and West Australia by Hedley (*Mar. Moll. Qnsld.*, p. 345, 1909; *Check-List Moll. W.A.*, p. 9, 1916). There is, however, an earlier *Plicatula imbricata* Koch and Dunker, 1837 (*Beitrage z. K. d. Nordd. Oolith.*, p. 50), so that a fresh name is needed.

Lima alata Hedley, 1898:— **Lima ales** n. n.
(*Rec. Austr. Mus.*, vol. 3, no. 4, p. 84.)

Not of Roemer, 1836 (*Verst. Norddeutsch Oolith*, p. 78), nor Lycett, 1850 (*Ann. Mag. Nat. Hist.*, ser. 2, vol. 6, p. 420). Described from Santa Cruz in the South Pacific.

Lima (Limatula) huttoni Woods, 1917:—
Limatula woodsi Suter, 1922.
(*N.Z. Geol. Surv. Pal. Bull No. 4*, p. 27.)

Suter, having already used this name himself (*N.Z. Geol. Surv. Pal. Bull. No. 2*, p. 45, 1914) when renaming *L. multiradiata* Hutton, 1873, *non* Gabb, 1868, proposed the substitute *L. (Limatula) woodsi* n. n. for Woods's species in an MS. letter of 1918, which was published under his name in 1922 (*N.Z. Geol. Surv. Pal. Bull. No. 8*, p. 3).

Lima laevigata Hutton, 1873:— **Lima levitesta** n. n.
(*Cat. Tert. Moll.*, p. 33.)

Not of McCoy, 1844 (*Synop. Carb. Foss. Ireland*, p. 88).

Dr. Marwick informs me that this species is in some obscurity, as the type is lost, and he has seen no authentic specimens; I had, therefore, at first decided that the name might be ignored altogether. However, Hutton gave as localities, "Waihola Gorge" and "Cobden," and there are in the collection of the Otago School of Mines several large

specimens from the Milburn limestone which agree perfectly with Hutton's description. It is practically certain that these specimens are topotypes, and the species must apparently be recognized. I therefore rename it as above, and have selected and marked the most perfect of the specimens mentioned as neotype of the species.

Ostrea incurva Hutton, 1873:— **Ostrea wollastoni** n. n.
(Cat. Tert. Moll., p. 35.)

Not of Nilsson, 1827 *(Petref. Suecana,* p. 30); a well-known European Cretaceous species.

Pinna semicostata Tate, 1886:— **Atrina tateana** Hedley, 1924.
(T.R.S.S.A., vol. 8, p. 122.)

Not of Conrad, 1837 *(Journ. Acad. Nat. Sci. Philad.*, vol. 7, p. 245); alteration made by Hedley in *Rec. Austr. Mus.*, vol. 14, no. 3, p. 143.

Avicula alata Etheridge, 1872.
(Quart. Journ. Geol. Soc., vol. 28, p. 342.)

This was referred to *Pseudavicula* by Etheridge jr. in 1892 *(Geol. Pal. Qnsld. & New Guinea*, p. 563), but in choosing a trivial name Etheridge was anticipated by Kloeden, 1834 *(Verst. Mark Brandenburg*, p. 198), while d'Orbigny also placed McCoy's *Cypricardia alata* in this genus *(Prodr. Paleont.*, vol. 1, p. 136). However, Etheridge jr. decided later *(Mem. Roy. Soc. S.A.*, vol. 2, pt. 1, p. 11, 1902) to place the species as a synonym of Moore's *Avicula barklyi* *(Quart. Journ. Geol. Soc.*, vol. 26, p. 245, 1870), so no substitute need be proposed.

Crassatella astartiformis Tate, 1886:—
Salaputium communis (Harris, 1897).
(T.R.S.S.A., vol. 8, p. 147.)

Noting the preoccupation of this name by Nyst, 1847 *(Bull. Ac. Roy. Brux.*, vol. 14, pt. 2, p. 117), Cossmann *(R.C.P.*, vol. 17, 1913, no. 1, p. 64) proposed to substitute for it *C. tatei* n. n. But Tate and Dennant had long ago become aware of the invalidity of the name, and omitted *astartiformis* from their lists, replacing it by *Crassatella communis* *(T.R.S.S.A.*, vol. 17, pt. 1, p. 224, 1893). It is here, however, like *Siphonalia tatei,* a pure list-name, introduced for the first time into print, but without any definition or standing, and cannot be legally recognized as a substitute name. The first published notice that *communis* is in lieu of *astartiformis* is that of Harris *(Cat. Tert. Moll. B.M.*, pt. 1, p. 364, 1897), who must, therefore, be credited with the rectification and the name. The only other printed statement of the equivalence of the two names seems to be by May *(P.R.S. Tas.*, 1918, p. 104). This species is undoubtedly congeneric with *C. fulvida* Angas, the genotype of *Salaputium* Iredale, 1924 *(P.L.S.N.S.W.*, vol. 49, pt. 3, p. 204).

It may be mentioned that *Crassatella sowerbyi* var. *obesa* S. V. Wood 1871 *(Mon. Pal. Soc.*, 1871, p. 169), proposed for a British Eocene species, and recorded under this name by Newton *(Brit. Olig.*,

and Eocene Moll., p. 32, 1891), clashes with the New Zealand Recent species *C. obesa* A. Adams, 1854 (*Proc. Zool. Soc.*, for 1852, p. 90); for the English species I propose *C. sowerbyi searlesi* n. n.

Crassatella parva Martin, 1879:— **Salaputium martini** n. n.
(*Tertiars. auf. Java*, p. 109.)

C. B. Adams (*Panama Shells*, etc.) proposed this name in 1852.

Cardita scabrosa Tate, 1886.
(*T.R.S.S.A.*, vol. 8, p. 152.)

This invalidates *C. scabrosa* Noetling, 1901 (*Pal. Indica*, N.S., vol. 1, no. 3, p. 162), a Burmese Miocene species, which I now rename *Cardita fritzi* n. n.

Venericardia ponderosa Suter, 1913.
(*T.N.Z.I.*, vol. 45, p. 295.)

In 1913 both Suter and Cossmann used the specific name *ponderosa* for a *Venericardia*, but Suter's name has priority by about three weeks, Cossmann's description (*Conch. Neo. de L. Aquit.*, Tome 2, livr. 1, p. 77) being published on the 1st July, while Suter's appeared on the 9th June. The French shell may be renamed *V. jouanneti titan* n. n. Both species belong to the section ***Megacardita*** Sacco, 1899, characterized by very large and very inequilateral shell, large and smooth ribs which are frequently effaced, and absence of lateral dental lamellae. Suter's shell is a magnificent species, unfortunately not at all well illustrated in the paper referred to.

Lucina affinis Tate, 1887:— **Lucina balcombica** Cossmann, 1912.
(*T.R.S.S.A.*, vol. 9, p. 143.)

Not of Eichwald, 1830 (*Nat Lithuaen*, p. 206); on this account renamed by Cossmann (*R.C.P.*, vol. 16, 1912, no. 3, p. 214).

Lucina anomala Moore, 1870.
(*Quart. Journ. Geol. Soc.*, vol. 26, p. 251.)

L. anomala Hoernes, 1848 (*Verz. Fossil-Reste Wien*, p. 26) is a *nomen nudum* and so will not affect Moore's name. The species is the type of *Pseudavicula* Etheridge jr., 1892.

Lucina oblonga Hedley, 1899:— **Lucina funafutica** n. n
(*Mem. Austr. Mus.*, vol. 1, p. 34.)

The name for this Funafuti species is preoccupied by *L. oblonga*. Philippi, 1836 (*Enum. Moll. Sic.*, vol. 1, p. 34).

Montacuta triquetra Suter, 1913:— **Parvithracia suteri** n. n.
(*Man. N.Z. Moll.*, p. 915.)

Not of Verrill and Bush, 1898 (*Proc. U.S. Nat Mus.*, vol. 20, p. 782). For ***Parvithracia*** Finlay, of which this species is the type, see earlier in this volume.

Diplodonta suborbicularis (Tate, 1887) (*Sacchia*).
(*T.R.S.S.A.*, vol. 9, p. 147.)

R. B. Newton (*Brit. Olig. and Eocene Moll.*, p. 48, 1891) has recorded, as an MS. name of F. E. Edwards, the same combination for a British Eocene fossil. Tate's name having six years' precedence, the British shell will need to be renamed when it is given standing by a description or figure.

Diplodonta subquadrata Tate, 1887:— **Diplodonta balcombensis** Pritchard, 1906.
(*T.R.S.S.A.*, vol. 9, p. 147.)

This was the fourth proposal of this name. Carpenter appropriated the name in 1855 (*Proc. Zool. Soc.*, 1855, p. 230), so Pritchard rightly renamed the Australian fossil (*Vict. Naturalist*, vol. 23, p. 119, 1906). *D. gabbi* Dall has been substituted for *D. subquadrata* Gabb, 1873. Lastly, Edwards proposed the same name in MS. for a British Eocene shell (see Newton, *Brit. Olig. and Eocene Moll.*, p. 48, 1891), for which Cossmann has proposed the substitute *D. newtoni* (*R.C.P.*, vol. 11, 1907, No. 2, p. 118); neither name, of course, can be recognized, both being *nomina nuda*.

Tellina aequilatera Tate, 1887:— **Tellina ralphi** n. n.
(*T.R.S.S.A.*, vol. 9, p. 166.)

Not of Koch and Dunker, 1837 (*B. z. K. d. Norddeutsch Oolith.*, p. 30).

Tellina (Arcopagia) inconspicua Marshall, 1918:— **Pseudarcopagia (?) marshalli** n. n.
(*T.N.Z.I.*, vol. 50, p. 272.)

Stolickza (*Pal. Indica*, vol. 3, p. 129, 1870) has referred Sowerby's *Psammobia inconspicua* (*Trans. Geol. Soc. Lond.*, vol. 7, p. 142) to *Tellina (Palaeomoera)*, but the acceptance of *Palaeomoera* as of generic rank would remove any clash here. There is, however, a species described as *Tellina inconspicua* by Broderip and Sowerby, 1829 (*Zool. Journ.*, vol. 4, p. 363) which is sufficient to invalidate Marshall's name.

Tellina rotunda Martin, 1887:— **Tellina mutata** n. n.
(*S.G.R.M.L.*, ser. 1, bd. 3, p. 203.)

Not *Tellina rotundata* Montagu, 1803 (*Test. Brit.*, p. 71), nor of Boettger, 1875 (*Palaeontographica*, Suppl. 3, lief. 1, p. 29), nor of Sowerby, 1867. The addition of "ta" to an adjective such as *rotunda* does not produce a word which can be considered as a diminutive or other derivative, the two adjectives must be considered as substantially the same, and therefore conflicting with each other. In this connection, it may be noted that the following entry occurs in Woods' Monograph of the Cretaceous Lamellibranchs of England, vol. 2, pt. 3, p. 102 (in *M.P.S.*, vol. 60, 1906):—

"1842. *Astarte oblongata* Desh., in A. Leymerie. Mem. Soc. Geol. de France, ser. 2, vol. 5, p. 24. (*non oblonga* Sowerby, 1826.)"

Woods therefore rejects *oblongata* and uses *A. elongata* d'Orb., 1844 as the name for the species. Another case is that of *Cardita planicostata* Noetling, 1901 *(Pal. Indica,* N.S., vol. 1, no. 3, p. 170) which cannot be considered a distinct name from the well-known *C. planicosta* Lamarck, 1806 *(Ann. Mus.,* vol. 7, p. 55); I therefore rename the Burmese Miocene shell *Venericardia noetlingi* n. n.

Mactra crassa (Hutton, 1885) *(Hemimactra)*:— **Mactra crassitesta** n. n.
(T.N.Z.I., vol. 17, p. 322.)

Not *Mactra crassa* Turton, 1822 *(Conch. Insul. Brit.,* p. 69).

Venus pulcherrima Martin, 1883:— **Chione martini** n. n.
(S.G.R.M.L., ser. 1, bd. 1, p. 250.)

Not of Deshayes, 1860 *(Journ. de Conchyl.,* vol. 8, p. 381).

Chione halli Tate, 1900:— **Chione roberti** Pritchard, 1906.
(T.R.S.S.A., vol. 24, p. 107.)

Pritchard, having previously used this name himself *(P.R.S. Vict.,* vol. 7, N.S., p. 229, 1895), renamed Tate's species in *Vict. Naturalist,* vol. 23, p. 119, 1906.

" **Chione multitaeniata** Tate."

This occurs first as a list name *(T.R.S.S.A.,* vol. 17, pt. 1, p. 225, 1893), and was apparently intended to replace *C. multilamellata* Tate, 1887 *(l.c.,* vol. 9, p. 154), for it occurs again in place of this name in *Rec. Geol. Surv. Vict.,* vol. 1, pt. 2, p. 125, 1903. It is, of course, still a *nomen nudum.*

Cytherea tenuis Tate, 1887:— **Notocallista tatei** (Cossmann, 1920).
(T.R.S.S.A., vol. 9, p. 159.)

Renamed by Cossmann *(R.C.P.,* 1920, no. 1, p. 37) on account of prior use of *tenuis* by Hall and Meek, 1854. For *Notocallista* Iredale, 1924, type *C. kingi* Gray, see *P.L.S.N.S.W.,* vol. 49, pt. 3, p. 210, 1924.

Dosinia tumida Marshall, 1918.
(T.N.Z.I., vol. 50, p. 271.)

Were this a true *Dosinia* it would clash with *Artemis tumida* Gray, 1838, a Queensland *Dosinia,* but Dr. Marwick shows that it does not belong here, being referable to one of his new genera of the Antigoniidae.

Solecurtus ellipticus Tate, 1887:— **Solecurtus murrayvianus** n. n.
(T.R.S.S.A., vol. 9, p. 182.)

Not of Dana, 1849 (*Wilkes U.S. Explor. Exped.,* vol. 10, Geol., pl. 2, f. 9).

Corbula compressa Verco, 1896:— **Corbula verconis** n. n.
(T.R.S.S.A., vol. 20, p. 230.)

Not of Lea, 1833 *(Contrib. to Geol.,* p. 47), nor of d'Orbigny, 1846 *(Pal. Franc. Cret.,* vol. 3, Lamell., p. 458).

Panope angusta Hedley, 1915:— **Panope hedleyi** n. n.
(*P.L.S.N.S.W.*, vol. 39, p. 705.)

Not of Nyst, 1836 (*Mess. Sci. Arts Belg.*, vol. 4, p. 142), nor of d'Orbigny, 1850 (*Prodr. Paleont.*, vol. 1, p. 251) based on *Pleuromya angusta* Agassiz, 1845.

Cuspidaria inflata Martin, 1886:— **Cuspidaria martini** n. n.
(*S.G.R.M.L.*, ser. 1, bd. 3, p. 195.)

Bullen Newton (*Brit. Olig. & Eocene Moll.*, p. 90, 1891) has referred *Nucula inflata* J. de C. Sowerby, 1827 (*Min. Conch.*, vol. 6, p. 103) to *Neaera*, and later to *Cuspidaria* (*Addenda, l.c.*, p. 295). This would interfere with *Neaera inflata* Jeffreys, 1882 (*Proc. Zool. Soc.*, 1881, p. 942), but it is better to drop Jeffrey's name altogether than to supply a substitute, for Dall has shown (*Bull. Mus. Comp. Zool.*, vol. 12, no. 6, p. 301, 1886) that it covers several species, all of which had apparently been previously described. Both Jeffrey's and Sowerby's proposals, however, will render a substitute name necessary for the Javan fossil.

In passing, it may be noted that Edward's MS. name *Neaera lamellosa*, also listed by Newton, cannot be validated on account of the prior *Cuspidaria lamellosa* Sars.

BRACHIOPODA.

Genus **Aetheia** Thomson, 1915:—Genus **Thomsonica** Cossmann, 1920.
(*Geol. Mag.*, N.S., Dec. 6, vol. 2, no. 615, p. 389.)

This is preoccupied, as *Aethia*, by Huebner, 1826 (*Verz. bekannt. Schmett.*, p. 340), and by Merrem, 1788 (*Tent. Nat. Syst. Av.*, p. 7). Cossmann has noticed Huebner's use (though he wrongly gives the date as 1816), and has provided as a substitute *Thomsonica* n. n. (*R.C.P.*, vol. 24, 1920, no. 3, p. 137.)

Genus **Clavigera** Thomson, 1913.
(*N.Z. Geol. Surv. Pal. Bull. No. 1*, p. 50, 1913.)

This has been productive of some argument, and the matter is by no means settled yet. Originally proposed as a *genus caelebs* by Hector, the name was first validated by Thomson at the reference above given. Trechmann (*Quart. Journ. Geol. Soc.*, vol. 73, p. 216, 1918) rejects the name, saying, "I have considered it advisable to rename this group, and have called it *Hectoria*. Hector's description was published without any illustrations, and his subgeneric name closely resembles that of *Claviger*, given to a group of the Melanias." Thomson (*Geol. Mag.*, Dec. 6, vol. 6, no. 663, pp. 411, 412, 1919) reopened the discussion, and, quoting Buckmann's acceptance of *Cryptopora* and *Cryptoporus* as distinct generic names, argued for the retention of *Clavigera* Thomson vice *Hectoria* Trechmann. This will not hold. Under the international rules, masculine, feminine, and neuter endings to a generic name are considered equivalent and interchangeable. The only exception to this rule—acquiesced in and practised for long past by Cossmann, Dall, Hedley, Iredale, etc.—is the case where such endings signify words of different meaning, e.g., *Clava* Martyn, 1784 (a club), and *Clavus* Montfort, 1810 (a nail);

while *Clavis* (a key) would also stand as distinct. There is no such distinction, however, in the terminations "ger," "gera," and "gerum," and, in the absence of statement as to what meaning was intended by the stem "clav," anyone who wishes to abide by the rules must admit the equivalence of *Clavigera* and *Claviger*. That being the case, Thomson's name is antedated by Agassiz, 1846 (*Nomen. Zool. Index Univ.;* emend for *Clavifer* Laporte, 1835), for a beetle; Haldeman, 1842 (*Amer. J. Sci.*, vol. 42, pt. 1, p. 216), for a Gasteropod —the *Melania* group mentioned by Trechmann—; and Preyssler, 1790 (*Verz. Bohm. Ins.*, p. 68), for another beetle. Rovereto (*Atti. Soc. ligust di Sc. natur. e geogr.*, vol. 10, 1899) has already called attention to the preoccupation in the case of Haldeman's name, and provided the substitute *Hemipirena*. *Hectoria* Trechmann must, therefore, be considered as correctly substituted for *Clavigera* Thomson. Unfortunately, it must itself be also rejected, as *Hectoria* had been used earlier for a locust by Tepper (*T.R.S.S.A.*, vol. 12, p. 21, 1890). I therefore now supply *Hectorina* n. n. for *Hectoria* Trechmann, of which Thomson (*Geol. Mag.*, N.S., Dec. 6, vol. 6, p. 412, 1919) has selected as the genolectotype *Hectoria cuneiformis* Trechmann, 1918 = *Clavigera cuneiformis* Thomson, 1913. I apply *Hectorina* at present as also covering *Clavigera bisulcata* Thomson, the genolectotype of his *Clavigera;* should, as he suggests, any subsequent author consider that these are not congeneric, a new genus will be necessary for the latter.

Dielasma sacculum var. **amygdala** (Dana, 1847) (*Terebratula*):—
D. sacculum bensoni n. n.

(*Amer. Journ. Sci.*, vol. 2, no. 4, p. 152.)

Dun and Benson have included this in their "Census of the Lower Burindi Fauna" (*Mem. Geol. Surv. N.S.W.*, vol. 10, p. 37, 1921), but the combination *Terebratula amygdala* had been previously used by Catullo, 1846 (*Giorn. di Fisica*, vol. 2, no. 5, p. 90), so I rename the species as above.

Terebratulina cancellata (Kuster, 1843) (*Terebratula*):—
Terebratulina hedleyi n. n.

(*Conch. Cab.*, vol. 7, p. 35, as of Koch, MS.)

This well-known species (which, though generally referred to Koch, should be credited to Kuster) is recorded from South Australia by Verco (*T.R.S.S.A.*, vol. 34, p. 95, 1910), from Tasmania by May (*Check-List Moll. Tas.*, p. 106, 1921), and from New South Wales by Hedley (*Check-List Mar. Moll. N.S.W.*, p. 113, 1918), but apparently the name must go, as there is a prior *Terebratula cancellata* Eichwald, 1829 (*Zool. Spec.*, vol. 1, p. 276). It is curious that only this name, and not Koch's, is recorded by Sherborn (*Index Anim.*, *2*, pt. 5, p. 1034, 1924). For *T. cancellata* Kuster I therefore propose *Terebratulina hedleyi* n. n.

The Genetic Relationships of Australasian Rissoids.

Part 1. Descriptions of New Recent Genera and Species from New Zealand and Kermadec Islands.

By A. W. B. POWELL.

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Plates 26-28.

PRIOR to Iredale's (1914-15) Commentary, the Australasian Rissoids, prejudiced by their small size and infinite variety of design, were, with a few exceptions, lumped in a conventional manner in the genus *Rissoa,* of world-wide range, comprising species of very diverse origin.

Iredale, in the above-mentioned paper, proposed eight new genera to cover Australasian forms and utilized five previously described, of which only two were proposed for southern shells. His new genera were, however, quickly adopted by Australasian systematists, the classification being recognized as a decided advance.

Finlay, in a valuable paper entitled "N.Z. Tertiary Rissoids" (1924, p. 483), proposed still another genus, but the majority of his new species were easily and naturally located by means of Iredale's new series of genera.

In the present paper sixteen new species are described, ten of which fall into previously described genera. In order, however, correctly to express the remaining six species, it has been found necessary to propose five new genera. Some of these new genera are, however, represented in other parts of Australasia by species that have hitherto been ascribed to other groups.

If a genus is represented by only one group of undoubted genetic affinity, it should be kept so and not forced to contain species only superficially similar. If several of these aberrant forms themselves resolve into a compact group, it is, in the opinion of the writer, sufficient justification to warrant their generic separation, even on shell characters, where morphological evidence is unavailable. Then these naturally-compiled genera based on evolutionary lines become of great importance to the geologist for the purpose of discussing geographical distribution and geological correlation.

It may be argued that this system unnecessarily complicates the nomenclature and that there is a danger of creating almost as many genera as species, but, on the other hand, there is little doubt that only a very small percentage of the New Zealand Rissoid fauna is known, and that further collecting will swell the ranks of these at present poorly represented types.

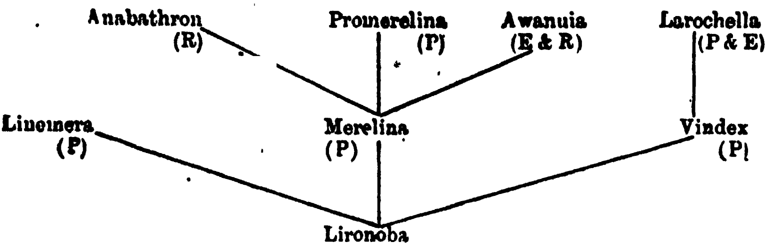
Including the additions recently made by Iredale and Finlay and those described in this paper, the N.Z. Rissoid fauna now numbers sixty-nine species, representing twenty genera. Probably all these species are restricted to New Zealand, many being extremely local. Most of the genera are represented in either south-eastern Australia, Tasmania, or Kermadec Islands, but are not found elsewhere, and show little connection with the northern hemisphere series. *Rissoina*

seems to be the only widely-distributed genus at present located in the *Rissoids*, but probably the affinity to the Rissoids is not so close as shell characters indicate.

Acknowledgments.—The writer is indebted to Mr. W. A. La Roche and Mr. R. A. Falla for dredgings and samples of shell-sand, and to Mr. G. Archey for permission to sort and describe new species from a Kermadec Islands dredging contained in the Auckland Museum collections.

Key to genera grouped around Merelina with diagram showing suggested ancestry.

Genus	Time, range and recent distribution	Protoconch	Peristome	Adult Sculpture
Lironoba Type *L. suteri* (Hedley)	*Miocene—Recent* Southern N.Z. Tasmania and s.e. Australia	A. Smooth (Typical) or B. Spirally lirate	Continuous; variced; with sub-sutural sinus	Spiral Keels
Linemera Type *L. interrupta* (Finlay)	*Miocene—Recent* Northern N.Z. Tasmania and s.e. Australia	Smooth	Continuous; thin; with sub-sutural sinus	Clathrate
Merelina Type *M. cheilostoma* (T. Wds.)	*Recent* Throughout N.Z. Snares & Bounty Is. Kermadec Is. Tasmania, s e. Australia and Loyalty Is.	Spirally lirate	Continuous; variced; with sub-sutural sinus	Clathrate
Vindex Type *V. neozelanica* (Suter)	*Recent* New Zealand	4 Spiral Keels	Discontinuous; thin; not expanded	Clathrate strong spirals, weak axials
Larochella n.g. Type *L. toreuma n.sp.*	*Recent* North Is. N.Z.	Axially ribbed, crossed by faint spiral striæ	Discontinuous; thin; expanded; sinuous	Heavy rounded spiral keels, axially ribbed. The whole shell with dense spiral striæ
Anabathron Type *A. contabulatum* (Frfld.)	*Recent* Snares Is., N.Z., s.e. Australia, New Caledonia.	Spirally striate	Continuous; variced.	Spiral keels with axial foliations
Promerelina Type *P. crosseaformis* (Powell)	*Recent* Northern N.Z.	Granular spiral lines	Continuous; variced; with sub-sutural sinus; free columella	Clathrate or with axials obsolete
Awanuia n.g. Type *A. dilatata n.sp.*	*Recent* Northern N.Z.	3 spiral keels	Continuous as a callus; thin, expanded; with sub-sutural sinus	Strong axial



P = Progressive evolution
R = Recessive characters
E = Environmental adaptions

Lironoba and *Linemera* are the two oldest genera in the above series, both ranging from Awamoan (Miocene) to Recent. The genotype of *Lironoba,* the Recent New Zealand *suteri,* has a smooth protoconch while the two fossil species *polyvincta* Finlay and *charassa* Finlay have, in common with the Recent south-eastern Australian *wilsonensis* Gat. & Gab. a spirally lirate nucleus, although agreeing perfectly with the genotype in all adult characters. Finlay (1924, p. 486), however, considers the New Zealand Miocene *polyvincta,* Pliocene *charassa,* and Recent *suteri* an evolutionary series.

Thus, in *Lironoba,* contrary to other Rissoids, the nuclear characters seem variable. No genera proposed or adopted in this paper, however, are based on nuclear variation only, adult sculpture and type of aperture being also taken into consideration.

Although the Recent New Zealand Rissoids had, until quite lately, been given little attention, still less has been given to fossil species, Finlay's paper on the New Zealand Tertiary species being the first reliable census. The number of known fossil genera and species must not, therefore, be considered representative. No doubt the widely-distributed Recent *Merelina* will yet be found fossil associated with *Lironoba* and *Linemera,* both of which also share a wide recent Australasian distribution.

MERELINA

Of the three species of *Merelina* described below, *superba* is the nearest to the genotype; *gemmata* is related *to australiae* (Frauenfeld), both having a depressed protoconch, sculptured with three spirals only, while *compacta* has a similarly-shaped nucleus with more numerous spirals, but not so many as in genotype. Although differing slightly in apical features, the apertures in all above-mentioned species show no variation from genotype. The nuclear sculpture in *Merelina* is always in form of plain spirals, not granulated as in the related genus *Promerelina* proposed by writer (1926, p. 593) for two species, each with a remarkable large basal ridge and free columbella in addition to the apical difference.

Merelina superba n. sp. (Fig. 2).

Shell small, solid, clathrate. Protoconch typical, spirally striate of of 1½ convex papillate whorls,, sculptured with ten spiral striae.

Whorls 6½. Suture narrowly but distinctly margined. Sculpture consisting of strong spirals crossed by stronger axials, slightly nodulus at points of intersection. First post-nuclear whorl with two spirals, following three developing a third rib and body-whorl with four, plus an inconspicuous sub-sutural fifth and three on base. Axials strong, reaching from suture to suture, but not extending over base, enclosing where they cross the spirals, horizontal rectangular spaces. Aperture typical, thickened with a varix, peristome continuous, double with a slight indentation above, near suture. Colour buff, banded just below suture and coloured on base with light brown.

Height, 3.6 mm.; diameter, 1.4 mm.

Holotype in author's collection, Auckland.

Habitat: Maro Tiri (Chicken Island (type) in shell sand. (Coll. R. Falla, Dec., 1923); Mangonui in 6-10 fathoms (one specimen from dredgings by W. La Roche, June, 1924).

Distinguished from the related Australian *gracilis* (Angas) and *cheilostoma* (Ten.-Woods) by the greater number of spiral keels and consequent difference in outline.

Merelina gemmata n. sp. (Fig. 1).

Shell small, solid, clathrate. Protoconch depressed dome shaped of 1½ whorls sculptured with three spirals. Whorls 5½. Sculpture consisting of strong spirals crossed by strong broad axials rendered nodulus at points of intersection. Post-nuclear whorls with three spirals, the lower two more prominent, body-whorl developing four plus two on base. Outlines roughly oval, very little indented at sutures. Aperture typical, thickened with a varix, peristome continuous, double with a slight indentation above, near suture. Colour white, shining. Height, 2.9 mm.; diameter, 1.25 mm.

Holotype in author's collection, Auckland.

Habitat: Maro Tiri (Chicken Island (type) and four paratypes in shell sand (Coll. R. Falla, Dec., 1923); Taupo Bay, Whangaroa (1 sp. collected by W. La Roche).

This species is closely related to the Australian *M. australiae* (Frauenfeld) which has a similar paucispiral protoconch but has 1 whorl less than *gemmata*, an extra spiral on body-whorl is proportionately broader and a smaller shell.

Merelina compacta n. sp. (Figs. 5, 5a).

Shell minute, solid, clathrate. Protoconch large depressed, rounded of 1¾ whorls sculptured with 6 spirals. Whorls 4. Suture narrowly margined. Sculpture consisting of heavy rounded spirals crossed by regularly-spaced stronger axials extending from suture to suture and over base.

First two post-nuclear whorls sculptured with two spirals, body-whorl with three, the upper two strongest, plus three more on base. Although heavy and prominent the sculpture does not enclose sharply outlined rectangular spaces. Aperture typical thickened, with a varix, peristome continuous, double, with a slight indentation above, near suture. Colour uniformly buff.

Height, 1.35 mm.; diameter, 0.65 mm.

Holotype in author's collection, Auckland.

Habitat: Mangonui in 6-10 fathoms (holotype and 1 paratype from dredgings by Mr. W. La Roche, June, 1924).

Differs from the *cheilostoma,* typical series, in the relatively larger and depressed form of the protoconch, with fewer striations.

Merelina pisinna (Melvill Standen) (Fig. 11).

Alvania pisinna Melv. & Stand., *Journ. Conch.*, 8 (1896) 305.

A figure is provided of the species recorded as above from 10-30 metres near Sunday Id., Kermadec Is. (Oliver, 1915, p. 519), in order to illustrate the curious straight-sided protoconch. The type is from the Loyalty Is., so when specimens from both localities are critically compared the Kermadec shells may prove distinct.

Rissoids have two main types of apertures according to environment. Shells living under stones, in sand, and in shingle, formed to withstand its battering action are solidly built with thickened, often variced apertures, while those always found clinging fast to the protecting fronds of seaweeds are much more fragile, having thin, often expanded apertures. The heavily variced *Merelina* and *Promerelina* are found either under stones, in shell-sand, or in dredgings. The species described below, having apical features somewhat similar to *Merelina,* but a thin expanded lip shows apparent evolution of a distinct genus due to change of environment. Although all available specimens were dead shells from shallow-water dredgings and shell-sand, most of the associated species were typical seaweed-frequenting species, indicating its true station in life. That these adapted forms continue to breed true to their acquired structural changes is evident by the series collected, thus showing their right to be considered distinct from the series they branched off from. The environmental change, necessarily extreme to bring about so sudden a change; also indicates the improbability of the existence of intermediate forms, thus the two series continue to flourish apart.

AWANUIA n. gen.

Type: *Awanuia dilatata,* Powell.

Protoconch large, depressed, rounded, sculptured with 3 spiral ridges. Strong axial ribs on all post-nuclear whorls. Peristome thin, continuous as a callus across parietal wall, widely expanded on free portion of lip, with a distinct, broad, shallow sinus between suture and shoulder, being much more pronounced than in *Merelina.* Peristome strengthened with fine radiating riblets, quite the reverse to the concentrically thickened, variced, outer lip of *Merelina.* In addition to the distinctive mouth-characters, *Awanuia* differs from *Merelina* in adult sculpture which consists of axials only, with exception of first post-nuclear whorl, on which, in addition to axials, are two faintly indicated spiral threads, sufficient, in conjunction with the spirally ribbed protoconch to show the ancestral relationship to *Merelina.* The genus *Larochella* also described in this paper is still another example of a Rissoid with this type of aperture, adapted for a life on seaweeds.

Awanuia dilatata n. sp. (Fig. 3).

Shell minute, thin, white. Protoconch large, depressed, rounded of 1½ whorls, sculptured with three spiral ridges. Whorls 4½, with flattened sides sharply angled above and at periphery. Shoulder slightly concave. Base smooth. Sculpture on all post-nuclear whorls consisting of prominent axial ribs crossed on the first post-nuclear only by two faintly-indicated spiral threads. Peristome thin, continuous as a callus across parietal wall, widely expanded on free portion of lip, strengthened on the inside by faint radiating riblets and with a broad distinct, shallow sinus above, between suture and shoulder.

Height, 1.5 mm.; diameter, 0.8 mm.

Holotypes and paratypes in author's collection, Auckland, also paratypes in Auckland and Dominion Museums.

Habitat: Awanui (or Rangaunu Bay) in twelve fathoms. Mangonui in 6-10 fathoms (type); many dead shells from dredgings by W. La Roche.

For *Mathilda neozelanica* Suter and *Alics succincta* Suter, Iredale and Finlay have proposed a new genus *Vindex,* citing the former species as type and provisionally locating the genus near *Lironoba.* The protoconch is sculptured with four spiral keels, the adult whorls being also heavily keeled, crossed by weak axials, while the peristome is thin and discontinuous.

LAROCHELLA n. gen.

Type: *Larochella toreuma* Powell.

The above new genus is proposed for the two species described below, the protoconch being sculptured with strong regularly-spaced axial ribs, crossed by numerous fine spiral lirae. Although these shells recall *Vindex* in shape and general appearance, the nuclear characters are quite dissimilar, as also is the adult type of sculpture and aperture. Adult sculpture consists of heavy rounded keels, crossed on the keels only by prominent axial ribs, while the whole shell is crowded with numerous fine spiral lirae. Peristome thin, slightly expanded where free and connected as a thin callus across parietal wall. Outer lip sinuous, indented corresponding to the termination of the interstices of the keels.

The type of aperture in this genus, as in *Awanuia,* indicates a structural change to suit environment. No doubt the seaweed-frequenting *Larochella* has evolved from *Vindex* of sandy and deep water habitat, for, in addition to the changed peristome, *Larochella* shows gradual evolution from *Vindex* by a more complex sculptural nucleus.

Genus named in honour of Mr. W. La Roche, of Auckland, whose extensive collection and dredging has resulted in many new species, genera, and records being added to the New Zealand fauna.

Known distribution North Island of New Zealand. *Vindex succincta* (Suter) is so far, known only from southern New Zealand. Odhner's record from Colville Channel in 35 fathoms refers to juvenile *Turritella vittata* Hutton, as shown by specimens received from recorder.

Larochella toreuma n. sp. (Fig. 4).

Shell minute, thin, white. Protoconch large dome-shaped, with nucleus slightly oblique of 1½ convex, axially-ribbed whorls crossed by numerous fine spiral lirae. Axials and their interstices of about equal width. Whorls 5½. Sculpture on all post-nuclear whorls consisting of three prominent rounded keels, the middle one by far the strongest. Keels only crossed by regularly spaced axials. All whorls crowded with fine spiral lirae. Peristome thin, slightly expanded where free and connected as a thin callus across parietal wall. Outer lip sinuous, being indented above and below, corresponding to the termination of the interstices of the keels.

Height, 1.25 mm.; diameter, 0.5 mm.

Holotype and one paratype in author's collection, Auckland.

Habitat: Houghton Bay, Cook Strait (seaweed-washings) A. W. B. P., May. 1925.

Larochella alta n. sp. (Fig. 6).

Shell minute, thin, white. Protoconch large, depressed, rounded, of 1½ convex axially ribbed whorls crossed by numerous fine spiral lirae. Interstices of axials equal to about 1½ times width of axials. Whorls 6½. Two heavy spiral keels on spire-whorls, the lower one much the stronger. On body-whorl a third keel equal in strength to the upper one proceeds from suture. Details of sculpture on all whorls as in foregoing species. Peristome thin, sinuous and identical with that of *toreuma*.

Height, 1.6 mm.; diameter, 0.6 mm.

Holotype and many paratypes in author's collection, Auckland. Paratypes also in Auckland, Dominion and Canterbury Museums.

Habitat: Mangonui in 6-10 fathoms (type) Awanui (or Rangaunu Bay) in twelve fathoms. (Many dead shells from dredgings by Mr. W. La Roche.)

From *toreuma, alta* differs in having a proportionately-smaller protoconch with wider spaced axials, one more adult whorl and only two keels showing on spire whorls. The main keel is also proportionately much stronger, giving the shell much more indented outlines.

ONOBA

Iredale, in his 1915 Commentary, p. 449, placed Webster's *Rissoa candidissima* and *R. carnosa* in the genus *Onoba* H. & A. Adams, and remarked that both species accurately agreed with *striata* Montagu, an English shell and genotype of *Onoba*. In the same paper, p. 450, he proposed *Subonoba* with *R. fumata* Suter, as type for a series of New Zealand shells, spirally grooved similarly to *Onoba*, but minus axials, semitransparent, no colour markings, and having a thin continuous peristome.

The genotype of *Onoba* is a tapering shell, spirally grooved, colour banded, with weak axials, a small protoconch and a discontinuous peristome, constricted above. *Carnosa* and *candidissima* only superficially resemble the English *Onoba*, the protoconch being proportionately much larger and in adult specimens the peristome continuous as a heavy callus.

Webster (1905, p. 278) gives dimensions of *carnosa* as 2.25 mm. x 0.75 mm. His enlarged figure, however, measures 32.5 mm. x 16.5 discontinuous peristome. In adult topotypes, of which one is figured was not the one described, but a juvenile, which accounts for the different proportion, axials extending strongly over body-whorl and discontinuous peristome. In adult topotypes, of which one is figured (Fig. 7), axials are less conspicuous on the last whorl and do not extend below periphery.

Suter (p. 222) gives dimensions as 3 mm. x 1.3 mm., but the writer has not seen any so large.

For the New Zealand and Kermadec Island shells hitherto recorded as *Onoba,* but differing from that genus in particulars mentioned above, a new genus, *Austronoba,* is proposed with Webster's *candidissima* as type, and to include *carnosa* Webster, *kermadecensis* nov. and *oliveri* nov. The genotype and allied *kermadecensis* nov. are always white, but *carnosa* and its evolutionary product *oliveri* nov. are coloured. This is not a constant feature, however, a few of *Oliveri* being white, but every intermediate form occurs between it and uniform brown and banded shells. I have not seen white *carnosa,* but uniformly brown shells are as common as the typical banded ones. *candidissima* resembles *Subonoba* by the absence of coloration and in having spiral sculpture and similar apical characters, but the presence of strong axials on all post-nuclear whorls separates it from that genus, which is always devoid of axials.

Iredale (1924, p. 244) proposed a new genus, *Botellus,* for Hedley's South Australian *O. bassiana* (type) and Queensland *O. glomerosa,* differing from typical *Onoba Austronoba* nov., and *Subonoba,* in being thick heavy shells with circular thickened apertures.

The known distribution of *Austronoba* is Northern New Zealand and Kermadec Island, of *Botellus* South Australis, Tasmania, and Queensland, and of *Subonoba,* throughout New Zealand and in the Antarctic.

Austronoba seems more closely related to *Subonoba* than to the Australian *Botellus,* thus showing a southern origin for the genus with no indications of a connection with *Onoba* of the northern hemisphere.

AUSTRONOBA n. gen.

Type: *Rissoa candidissima* Webster.

Shell thin, semitransparent, white, uniformly coloured or banded. Dense spiral sculpture crossed by prominent axials; protoconch smooth, dome-shaped; aperture ovate-pyriform, peristome thin continuous as a callus across parietal wall, not varicose.

Austronoba candidissima (Webster) (Fig. 12).

Webster's figure of this species does not show the essential characters, so a specimen is figured (1.9 mm. x 0.8 mm.) collected together with one other at Tryphena Bay, Great Barrier Island (Jan., 1924), from under-side of stone at low tide. Later, Mr. W. La Roche collected a single specimen from a similar station at Taupo Bay, Whangaroa. Webster's type was from Takapuna and measured 2 mm. x 1 mm.

Austronoba kermadecensis n. sp. (Fig. 8).

Shell minute, thin but not fragile, semitransparent, white. Protoconch large, dome-shaped, of two smooth whorls. Whorls five. Sculpture consisting of numerous narrowly rounded spirals crossed by distant slightly oblique axial ribs not extending below periphery. Peristome continuous as a heavy callus across parietal wall, outer lip not varicose.

From *candidissima, kermadecensis* differs in having a greater number of spirals, sixteen narrowly rounded spirals on body-whorl as compared with the twelve broad spirals of the first-named species. The diameter is also greater in proportion to height than in *candidissima.* Both Webster and Suter wrongly described the peristome of *candidissima* as being discontinuous for it is exactly the same type as described in *kermadecensis* nov. and typical of the other species of *Austronoba.*

Height, 1.76 mm.; diameter, 0.9 mm.

Type in Auckland Museum.

Holotype and many paratypes, all dead shells 10-30 metres off Sunday Id., Kermadec Is. (from dredgings in Auckland Museum, by R. S. Bell).

In ascribing *carnosa* to the Kermadec fauna, Oliver named four colour-varieties, *typica, fusca, alba,* and *bicolor.* No types, however, were designated, as his names were intended only to indicate colour-forms. Furthermore, the names were applied to a New Zealand shell, not really a constituent of the Kermadec fauna as shown below. The first name, *typica,* simply means *carnosa* typical, so cannot be used for the Kermadec shell, and the remaining colour-forms are not constantly distinct, so in the event of one of the names being raised to specific status, the others would fall as synonyms. As it is quite obvious that the names were not intended in a subspecific sense, but merely to indicate colour-forms, the proper course seems to be to employ an entirely new name for the Kermadec shell.

Austronoba oliveri n. sp. (Fig. 9).

Shell minute, thin, but not fragile, colour variable, entirely white or with the early whorls reddish brown, entirely brown, or with a broad white band above periphery. Protoconch large dome-shaped of two smooth whorls. Whorls five. Outlines convex, whorls slightly angled at periphery. Sculpture consisting of about twenty-five fine spiral riblets crossed by oblique axial costae about twenty on last whorl, stronger on spire than on body-whorl and not extending below periphery. Peristome continuous as a heavy callus across parietal wall, outer lip not varicose.

From *carnosa,* its closest ally, *oliveri* differs in the contour of the body-whorl, being noticeably more convex and slightly angled, with periphery high on the body-whorl and more numerous spirals. *Carnosa* has the whorls only slightly convex and the periphery angle much lower. In the large series examined these features are quite constant, the colour alone being variable.

Height, 2.25 mm.; diameter, 0.9 mm.

Type in Auckland Museum.

Holotype and many paratypes, all dead shells, from 10-30 metres off Sunday Id., Kermadec Is. (from dredgings by R. S. Bell) in Auckland Museum.

Both this species and *kermadecensis* nov. have evolved from the New Zealand species *carnosa* and *candidissima* respectively, to which two species the Kermadec shells had hitherto been ascribed.

Rissoa cylindrella Odhner (1924, p. 22, Pl. 1, f. 14), although similar superficially to *Austronoba,* cannot be included here on account of the spirally-striated protoconch indicating quite a different group. Until actual specimens are available, however, the exact position of this species must remain in doubt.

ESTEA Iredale (1915).

(*Trans. N.Z. Inst.*, 47, 451).

Estea semiplicata n. sp. (Fig. 17).

Shell of moderate size, solid, imperforate, protoconch dome-shaped of 1½ smooth whorls. Whorls 5½, spire conic, outlines almost straight, angled at periphery. Sculpture, smooth to the fourth whorl, then for a space equal to one whorl, strong axial plications suddenly develop and then disappear on last half-whorl. Plications extending from suture to suture, but not extending over base. Suture impressed, aperture almost circular, peristome continuous, edge thin and reflexed but internally thickened. Colour buff with a dark reddish-brown band on lower half of whorls but not extending below periphery.

Height, 2.5 mm.; diameter, 1.25 mm.

Holotype and paratypes in author's collection, Auckland.

Habitat: Taupo Bay, Whangaroa (type) coll. W. La Roche; Mangonui Heads; Tryphena Bay, Great Barrier Id. on under sides of stones at low tide (coll. A. W. B. P., 1924).

This species is slightly larger than *E. zosterophila* and is easily distinguished from it by presence of the axial folds, which are quite a constant feature, as indicated in the large series examined from several localities.

In other respects, however, in coloration, shape, and form of aperture, *semiplicata* shows close relationship to *zosterophila* and is no doubt an evolutionary product of that species.

Estea angustata n. sp. (Fig. 10).

Shell very small, rather thin. Protoconch dome-shaped of 1½ smooth whorls. Whorls 4½, smooth, spire tall, cylindrical, 2¼ times height of aperture, sides straight and parallel. Suture impressed, with an infrasutural groove below. Aperture typical, peristome continuous, thin, reflexed all round and internally thickened. Colour reddish-brown, lighter on body-whorl with a narrow dark-brown band at periphery, peristome white.

Height, 1.7 mm.; diameter, 0.5 mm.

Holotype in author's collection, Auckland.

Habitat: Mangonui in 6-10 fathoms (a few specimens from dredgings by W. La Roche). A very distinctive species characteristic of *Estea* but not closely related to any other known species.

Estea, ranging from Pliocene to Recent, is rather rich in species. Typical *Estea,* which is a solid opaque shell, has an almost circular aperture with a thin peristome, reflexed all round and joined to parietal wall only for a short space. The adult whorls may be smooth, ornamented with axial growth-lines, folds, or riblets, or spirally lirate sometimes with combined axial and spiral sculpture. This latter combination, however, seems to be confined to a few Pliocene species, the spirals being indicated as a recessive character absent in all Recent examples, excepting the occasional occurrence in some axially-costate species of a single infrasutural groove.

STRIATESTEA n. gen.

Type: *S. bountyensis* Powell.

The species described below, together with the Victorian *janjucensis* Gat. & Gab., and *iravadioides* Gat. & Gab., all here referred to above new genus, form a compact group only superficially reminiscent of *Estea,* to which genus the two Victorian species had previously been ascribed. Compared with *Estea, Striatestea* has a totally different type of aperture, is devoid of axial sculpture and is a much thinner and more fragile shell.

Shell small, tall, elongate-conic, thin, semitransparent, white. Protoconch small, smooth, conical. Adult whorls smooth to spirally ribbed or grooved. Aperture continuous, almost pyriform, constricted above and rounded below, thin and reflexed where free, but joined to body-whorl for whole extent of inner lip, which is marked off from body-whorl by a slight groove. Outer lip straight with axis of whorls, not retracted towards suture as in *Subonoba* and *Austronoba.*

Considering the comparatively wide range of this group in conjunction with such distinctive and constant shell-characters, the writer has no hesitation in proposing a new genus for the group. A single worn shell from Stewart Island, in shell sand, closely related to *bountyensis,* is withheld from description pending receipt of better material. Further collecting will, no doubt, disclose many other examples from intermediate localities.

Striatestea bountyensis n. sp. (Fig. 18).

Shell small, thin, semitransparent, white. Protoconch small, smooth conical of one whorl. Whorls four. Spire tall, twice height of aperture, outlines slightly convex. Suture impressed, faintly and narrowly margined. Sculpture, spire whorls smooth, base with three strong spiral ribs. Aperture continuous, almost pyriform, constricted above, rounded below, thin and reflexed where free, but joined to body-whorl for whole extent of inner lip, which is marked off from body-whorl by slight groove, inner lip very little curved but forming an acute angle above with outer lip.

Height, 1.4 mm.; diameter, 0.6 mm.

Holotype in author's collection, Auckland.

Habitat: South of Bounty Island in 170 fathoms (one sp. from dredgings by Capt. Fairchild, 1893).

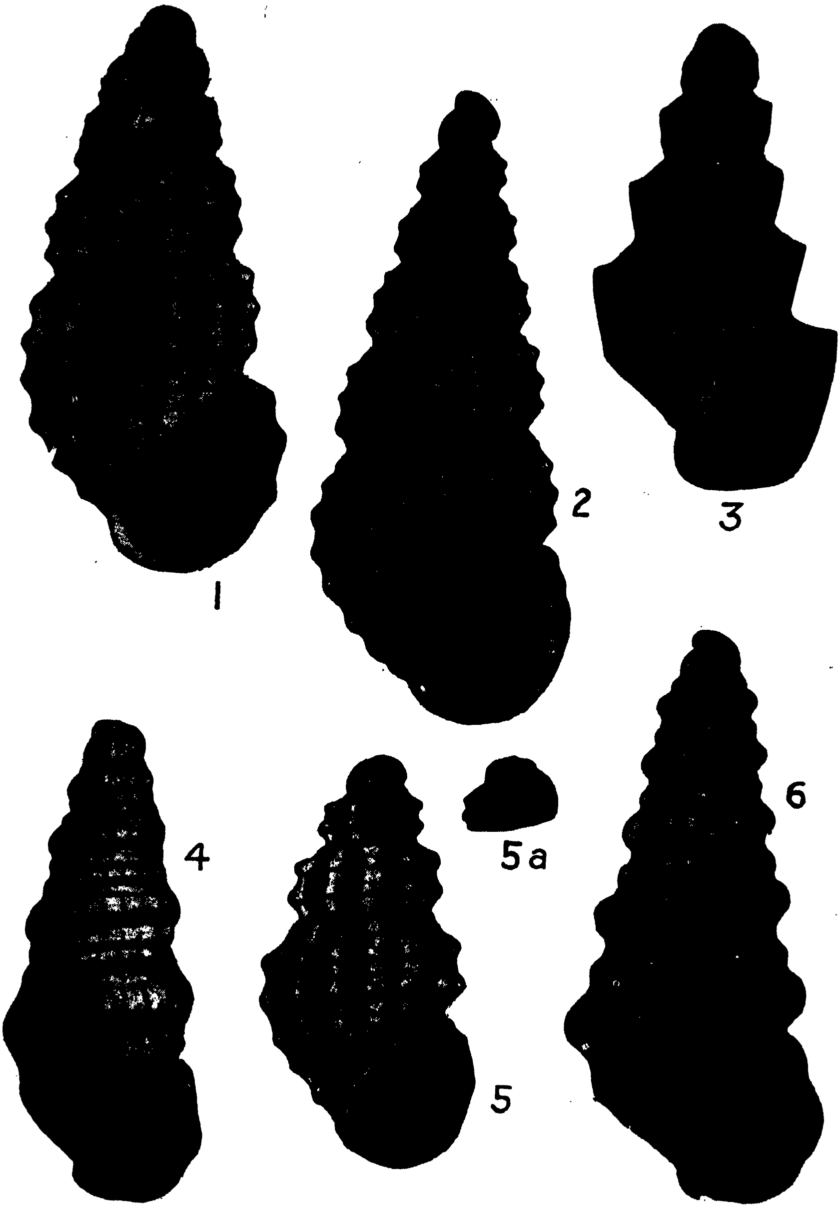


Fig. 1.—*Merelina gemmata* n.sp.
Fig. 2.—*Merelina superba* n.sp.
Fig. 3.—*Awanuia dilatata* n.sp.
Fig. 4.—*Larochella toreuma* n.sp.
Figs. 5 & 5a.—*Merelina compacta* n.sp.
Fig. 6.—*Larochella alta* n.sp.

Face p. 544.

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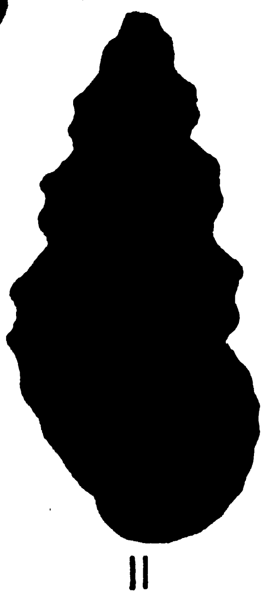

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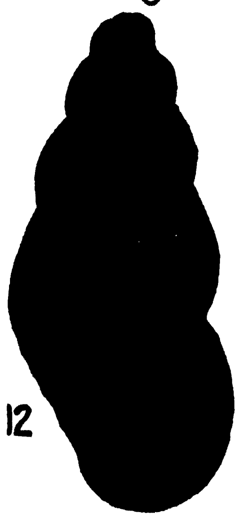


12

FIG. 7.—*Austronoba carnosa* (Webster).
FIG. 8.—*Austronoba kermadecensis* n.sp.
FIG. 9.—*Austronoba oliveri* n.sp.
FIG. 10.—*Estea angustata* n.sp.
FIG. 11.—*Merelina pisinna* (Melv. & Stand.)
FIG. 12.—*Austronoba candidissima* (Webster).

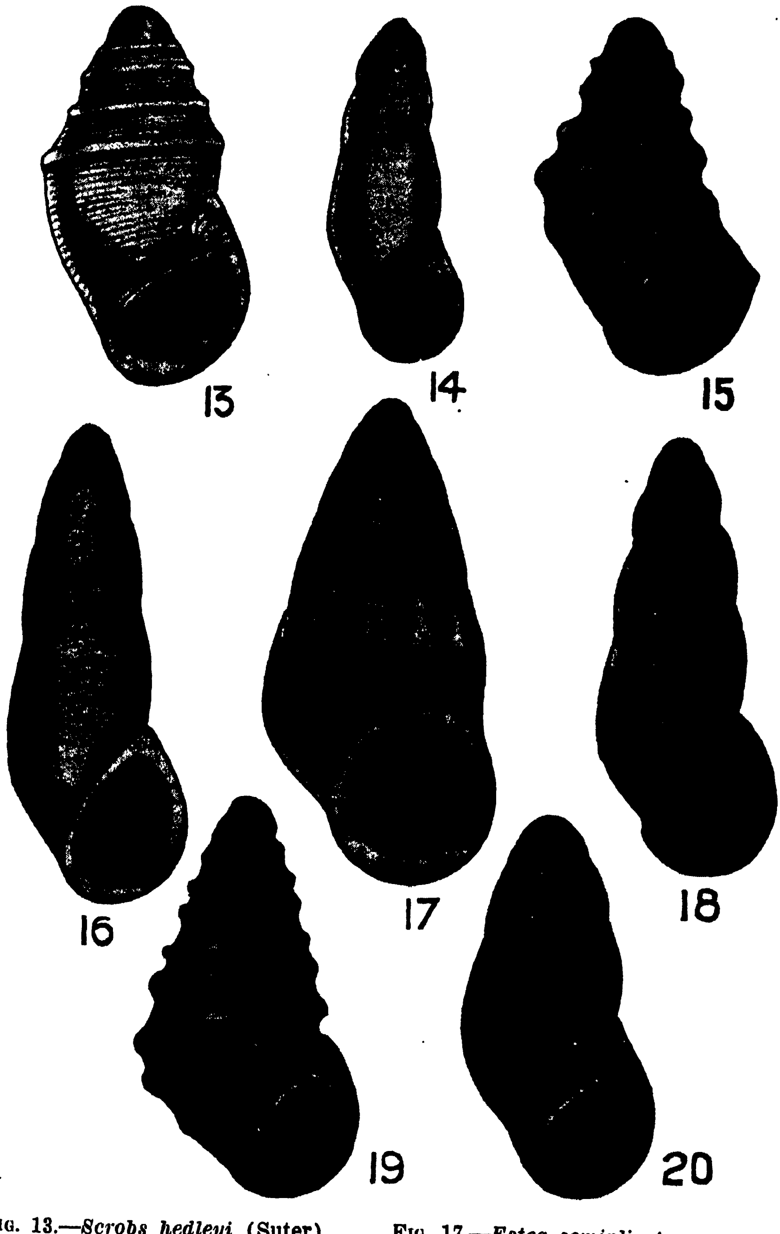


Fig. 13.—*Scrobs hedleyi* (Suter).
Fig. 14.—*Scrobs elongata* n.sp.
Fig. 15.—*Scrobs hedleyi angulata* n.subsp.
Fig. 16.—*Epigrus striatus* n.sp.
Fig. 17.—*Estea semiplicata* n.sp.
Fig. 18.—*Striatestea bountyensis* n.sp.
Fig. 19.—*Notoscrobs ornata* n.sp.
Fig. 20.—*Scrobs ovata* n.sp.

The associated material, however, contained many shallow water forms, such as *Gaimardia* and *Acmaea.* Probably the bulk of the material originated in shallow water, but was transported to greater depths by currents.

EPIGRUS Hedley (*Mem. Austr. Mus.* (1903) 355)

Epigrus striatus n. sp. (Fig. 16).

Shell minute, elongate-oval, solid. Protoconch smooth, of 1½ whorls. Whorls 4½ slightly convex, very finely spirally striated. Suture canaliculate with an infrasutural groove below. Spire twice height of aperture. Aperture oblique, oval, extended slightly beyond body-whorl and separated from it by a deep groove. Peristome very thick and rounded. Colour white.

Height, 1.5 mm.; diameter, 0.6 mm.

Holotype and one paratype in author's collection, Auckland.

Habitat: Mangonui in 6-10 fathoms (from dredgings by W. La Roche). The genus has not previously been recorded Recent from New Zealand, but is known fossil from Pukeuri (Miocene) represented by a single fragmentary specimen (Finlay, 1924, p. 489). This species *fossilis* is described as having no sculpture excepting fine growth-lines, and is a larger shell than *striatus.*

Epigrus is also known Recent from the Kermadec Islands, Tasmania and s.-e. Australia.

SCROBS Watson "*Challenger*" *Zoology* 15 p. (1886) 612

Type: *S. jacksoni* (Brazier)—*Rissoa* (*Scrobs*) *badia* Watson—*Amphithalamus* Carpenter (of Australasian Authors).

Iredale, in his 1915 Commentary, p. 449, wrote, "*Amphithalamus* is a name I have a great dislike to as it was given to a North American species, and the Austral species so called have an Austral name already available." This name is *Scrobs,* which is here adopted in preference to *Amphithalamus* for Australasian usage.

The resemblance of the Austral shells to *Amphithalamus* is merely superficial, prejudiced by the presence of a depression sparating aperture from body-whorl. In nuclear characters *Scrobs* is quite unlike *Amphithalamus,* this latter genus having protoconch sculptured with about fifteen slender spiral threads crossed by numerous very fine axial threads, giving the surface a minutely pitted appearance, while in *Scroba* the nuclear sculpture is in the form of numerous very fine stippled lines.

KEY TO SCROBS GROUPS.

A. Shell solid, ovate; apertue separated from body-whorl by sunken space:
  (a) Adult whorls, smooth. (Typical).
    1. *S. jacksoni* (Brazier)—S.-e. Australia, Tasmania.
    2. *S. luteofuscus* (May)—Tasmania.
    3. *S. sundayensis* (Oliver)—Kermadec Islands.
  (b) Adult whorls spirally striate or spirally keeled.
    4. *S. ovata* n.sp.—Northern New Zealand.
    5. *S. hedleyi* (Suter)—New Zealand.
    6. *S. hedleyi* var. *angulata* n. sub. sp.—Northern New Zealand.

B. Shell solid, slender, adult whorls with a few spirals on base; aperture not separated from body-whorl by sunken space but a slight groove in a shallow depression marks off inner lip from body-whorl.

7. *S. scrobiculator* (Watson)—S.-e. Australia.
8. *S. petterdi* (Brazier)—S.-e. Australia, Tasmania.
9. *S. elongata* n.sp.—Northern New Zealand.

C. Shell solid, spire tall, conic; adult whorls with a peripheral groove; aperture separated from body-whorl by a slight cleft.

10. *S. semen* (Odhner)—North Island, New Zealand.

Scrobs ovata n. sp. (Fig. 20).

Shell minute, solid, ovate. Protoconch of 1½ globose whorls sculptured with numerous fine stippled lines. Whorls 3½. Adult whorls smooth excepting a few spiral grooves on base. Suture distinctly margined. Aperture oblique oval, much thickened, and separated from body-whorl by a broad sunken callosity. Peristome continuous, double, the outer lip continuing over depression and joining body-whorl. Colour light reddish-brown, paler on base, with colourless peristome. Dead shells whitish, semitransparent.

Height, 1 mm.; diameter, 0.5 mm.

Holotype in author's collection, Auckland. Paratypes in Auckland, Dominion and Christchurch Museums.

Habitat: Awanui (or Rangaunu Bay) in twelve fathoms (type); Mangonui in 6-10 fathoms (from dredgings by W. La Roche).

Scrobs hedleyi (Suter) (Fig. 13).

Suter incorrectly described the protoconch of this species as being of one flatly convex smooth whorl. The nucleus is, however, typical of *Scrobs*, sculptured with the numerous fine stippled lines, and is large, dome-shaped, of 1½ whorls. His figure likewise does not correctly represent the species, so a figure of a topotype is provided.

Height, 1.2 mm.; diameter, 0.7 mm.

Scrobs hedleyi angulata n. subsp. (Fig. 15).

Shell differing from the species in shape and details of sculpture. The diameter, compared with that of *hedleyi*, is proportionately greater and the spiral keels are much more prominent, causing a sharp angle on the outer lip. The third keel shown in figure may be pronounced or only faintly indicated as a slight angle. Colour reddish-brown, lighter towards base, with aperture white, or the whole shell white. Similar to species in all other respects.

Height, 0.9 mm.; diameter, 0.6 mm.

Holotype in author's collection, Auckland.

Habitat: Mangonui in 6-10 fathoms (from dredgings by W. La Roche).

Both species and subspecies were found in this dredging, the latter predominating in number. A series of about thirty specimens was examined and, although variable, both kinds were well characterized and easily separable.

Scrobs elongata n. sp. (Fig. 14).

Shell minute, cylindrical, very solid, adult whorls smooth. Protoconch of two globose whorls, sculptured with numerous fine stippled lines. Whorls four, slightly convex. Suture distinctly margined. Aperture oblique, oval, much thickened with continuous double peristome, smooth inside, but surrounded with a broad, unevenly striated thickened area, widest on the inner lip, where it slopes towards the parietal wall, being marked off from it by a shallow groove. A slight fold proceeds from the base for a short distance on body-whorl, parallel with inner lip. The groove marks the bottom of a V shaped depression between the inner lip and basal fold. Colour light reddish-brown, paler on base, with colourless peristome. Dead shells whitish, semitransparent.

Height, 1.1 mm.; diameter, 0.45 mm.

Holotype in author's collection, Auckland. Paratypes in Auckland, Dominion and Christchurch Museums.

Habitat: Awanui (or Rangaunu Bay) in twelve fathoms (type); Mangonui in 6-10 fathoms (from dredgings by W. La Roche).

Scrobs semem (Odhner) *Papers from Dr. Th. Mortensen's Pacific Exp.*, 1914-16, 19, *N.Z. Mollusca*, p. 22, pl. 1, figs. 10, 11, 1924.

This species, described by Odhner as a *Rissoa*, is undoubtedly a *Scrobs*. Specimens agreeing exactly with *R. semem*, which is from Cape Maria van Diemen (on seaweeds) were recently collected by the writer at Houghton Bay, Cook Strait, also from seaweed-washings.

R. semem has a peripheral groove and other strong superficial resemblances to the s.-e. Australian *incidata* Frauenfeld, which Hedley, May, and Iredale have unhesitatingly located under *Estea*; but *Estea* has a smooth nucleus, while in *Scrobs* the protoconch is sculptured with numerous fine stippled lines.

The Cook Strait specimens undoubtedly represent Suter's New Zealand record of *incidata*, but, as they agree with *Scrobs semem*, they cannot equal *Estea incidata* unless the latter has been incorrectly described. The nuclear sculpture of *Scrobs*, however, is so fine that the slightest erosion would efface it, when species of this group of *Scrobs* would certainly resemble *Estea*, especially as the aperture is not noticeably separated from body-whorl as in typical *Scrobs*.

Rissoid species, being usually of restricted distribution, however, it is convenient to use Odhner's name for the New Zealand "*incidata*" until topotypes of both species are compared.

NOTOSCROBS n. gen.

Type: *Notoscrobs ornata* Powell.

The new species described below makes the third known example of a well defined group of *Scrobs* origin, but too dissimilar to form a natural association with the species of that genus. One of the species is from Tasmania and the remaining two from New Zealand, indicating in addition to the distinctive shell-characters that the genus is by no means of recent development.

COMPARATIVE KEY TO BOTH GENERA:

Scrobs: Shell solid, ovate, protoconch large dome-shaped, sculptured with numerous very fine stippled lines, adult whorls smooth, spirally striate or spirally keeled; aperture extending beyond body-whorl and separated from it by a sunken space, peristome continuous duplicated.

Notoscrobs: Shell solid, conical; protoconch large dome-shaped, sculptured with about 12 spiral rows of round shallow pits which, as they do not also form vertical rows produce a honeycomb effect, adult whorls with plain spiral keels, the uppermost crossed by axial ribs; aperture not separated from body-whorl, peristome continuous, duplicated, inner margin smooth and narrow surrounded by a broad flattened area, widest above and on parietal wall.

Notoscrobs ornata n. sp. (Fig. 19).

Shell minute, solid, conical, imperforate. Protoconch dome-shaped, of 1½ whorls, sculptured with about twelve spiral rows of minute round shallow pits spaced alternate with those of rows immediately above and below, giving a honeycomb effect. Whorls 4½. Spire conic, outlines straight. Spire-whorls sculptured with two spiral keels, the upper one crossed by slightly oblique strong axial ribs, last whorl plus three plain spiral keels on base.

Aperture oblique, oval, slightly constricted above, peristome duplicated, continuous with a smooth raised inner margin surrounded by an expanded slightly concave area, widest above and on parietal wall with its outer edge bounded by a slight ridge. Colour light reddish-brown, darker on keels.

Height, 1.3 mm.; diameter, 0.8 mm.

Holotype and several paratypes in author's collection, Auckland.

Habitat: Mangonui Heads in 5-6 fathoms (type) (from dredgings by W. La Roche, 1924); Maro Tiri (Chicken Island) in shell sand (coll. R. A. Falla, Dec., 1923).

Amphithalamus triangulus May (p. 95, Pl. 6, f. 32, 1915), and *Rissoa erosa* Odhner (p. 23, pl. 1, figs. 12, 13, 1924) both belong to Notoscrobs.

LITERATURE CITED.

FINLAY, H. J., 1924. N.Z. Tertiary Rissoids, *Trans. N.Z. Inst.*, vol. 55, pp. 480–494.

HEDLEY, C., 1918. A check-list of the Marine Fauna of N.S.W., Pt. 1, Mollusca, *Pro. Roy. Soc. N.S.W.*, vol. 51, pp. 52–54.

IREDALE, T., 1915. A commentary on Suter's *Manual* of the N.Z. Mollusca, *Trans. N.Z. Inst.*, vol. 47, pp. 447–454.

—— 1924. Results from Roy Bell's Molluscan Collections, *Pro. Linn. Soc. N.S.W.*, 49, pt. 3, p. 244.

MAY, W. L., 1915. Additions to the Tasmanian Marine Mollusca with descriptions of the New Species, *Pro. Roy. Soc. Tasmania.*

—— 1921. *A check list of the Mollusca of Tasmania*, pp. 49–53.

—— 1923. *W. L. May's Illustrated Index of Tasmanian Shells*, pp. 50–53.

ODHNER, N. H., 1924. *Papers from Dr. Th. Mortensen's Pacific Expedition*, 1914–16, 19, *New Zealand Mollusca.*

OLIVER, W. R. B., 1915. The Mollusca of the Kermadec Islands, *Trans. N.Z. Inst.*, vol. 47., pp. 519–521.

POWELL, A. W. B., 1926. Descriptions of Six New Species and a New Genus of Gasteropod Mollusca from Northern New Zealand, *Trans. N.Z. Inst.*, vol. 56, pp. 593–594.

WEBSTER, W. H., 1905. On some new Species of Shells, *Trans. N.Z. Inst.*, vol. 37, pp. 276–280.

Variation of the Molluscan Genus Verconella with Descriptions of New Recent Species.

By A. W. B. POWELL.

[*Read before the Auckland Institute, 24th November, 1925; received by Editor, 11th December, 1925; issued separately, 8th February, 1927.*]

Plates 29-31.

FOR the bulk of the material dealt with in this paper, the writer's thanks are due to the captains and crews of the trawling vessels operating from Auckland and Wellington respectively. Captain Ormes of the S.T. "Futurist," Wellington, and Mr. H. Hamilton of the Dominion Museum, were responsible for the addition to our fauna of the most interesting and handsome of the new species. Since the initial discovery, Captain Ormes has systematically collected many fine lots of material for the Dominion Museum.

It gives the writer much pleasure to associate with this new *Verconella* the name of its discoverer. The writer is also much indebted to Dr. J. A. Thomson for permission to describe this species, and also to Professor R. Speight for loan of valuable material from the Canterbury Museum.

Most of the Northern material was collected alive, but usually the animal was in an advanced state of decay before the specimens were received, consequently preservation of the soft parts was not possible. The opercula, however, were secured in most cases, and have proved very valuable for morphological discrimination between specimens showing variable shell characters.

Verconella Iredale, *Proc. Mal. Soc.* 11, p. 175, 1914.

Type: *Fusus dilatatus,* Q. & G.

Siphonalia, admitted by Suter and others to the Australasian fauna, has been shown by Iredale (1915, pp. 463-465) to be misapplied. *Siphonalia* is a Japanese genus of the *Buccinidae* while *Verconella* belongs to the family *Chrysodomidae* (Finlay, 1924, p. 501). The species now classed as *Verconella* have been greatly confused. Hedley (1920, p. 54) has shown that the New Zealand deep water shell ascribed to *Megalatractus maximus* (Tryon) by Suter is really the true *dilatata* of Quoy and Gaimard, while the shallow-water and littoral species usually recorded as *dilatata* must bear the name *adusta* of Philippi.

As so much confusion has centered around the recent records of the *Verconella* species, a thorough revision of the Tertiary species is essential before any attempt at geological range can be made. Finlay (1924, p. 501) has stated that neither the Recent *dilatata* nor *adusta* really occurs in Awamoan (Miocene) horizons, the records referring to new species of *Verconella*. Probably all the Miocene records refer to ancestral species distinct from Recent Shells.

(1) Identity of Species Discussed.

Adopted name.		*Suter's name (Man. N.Z. Moll.)*
Verconella dilatata (Q. & G.)	—	*Megalatractus maximus* (Tryon)
Verconella mandarina (Duclos)	—	*Siphonalia mandarina* (Duclos) *in part*
Verconella adusta (Philippi)	—	*Siphonalia dilatata* (Q. & G.)

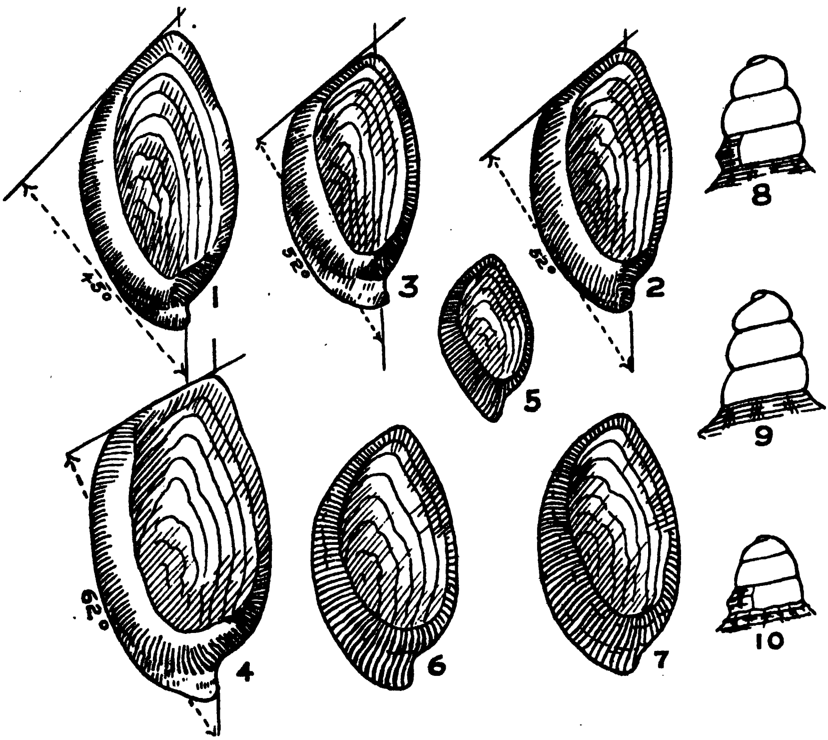
(2) Groups.

A. *Dilatata* (typical) group.

Confined to deep water. Comparatively thin shell. Operculum horny inside, with a white callus along outer margin of muscle-scar (Fig. 1). Protoconch of three and a half to four convex whorls, always brown (Fig. 8).

B. *Adusta group.*

Littoral to comparatively deep water. Heavy shell. Opercullum horny inside, always minus the white callus (Fig. 6). Protoconch of two and a half to three whorls, only slightly convex and always white (Fig. 10).



Opercula of *Verconella* (all ¾ natural size.).

FIG. 1.—*Verconella dilatata* (Q. & G.) of sp. 1435.
FIG. 2.—*Verconella dilatata* var. *cuvieriana* n. subsp. (of holotype).
FIG. 3.—*Verconella elongata* n. sp. (of holotype).
FIG. 4.—*Verconella ormesi* n. sp. (of holotype)
FIG. 5.—*Verconella mandarina* (Duclos) (of f. 8, pl. C.).
FIG. 6.—*Verconella adusta* (Philippi).
FIG. 7.—*Verconella adusta* var. *mandarinoides* n. subsp. (of holotype).

Protoconchs (all × 4)

FIG. 8.—*dilatata* (Q. & G.).
FIG. 9.—*ormesi* n. sp.
FIG. 10.—*adusta* (Philippi).

(3) Types of Specific & Individual Variation.

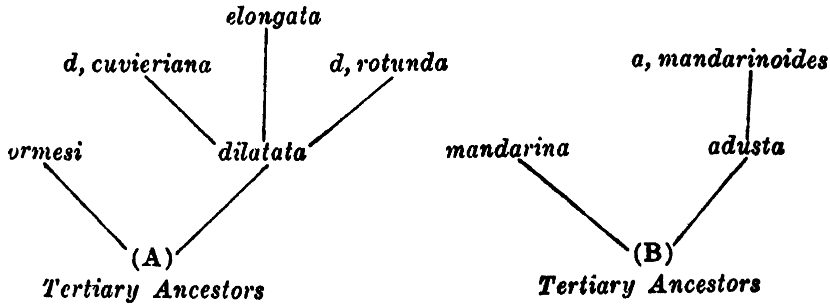
Group A.

1. *dilatata* (Q. & G.)
   Gradual change from typical form to thinner and proportionately narrower shell as depth increases (See table). Individual variation in strength of peripheral keel.
2. *dilatata, cuvieriana,* n. subsp.
3. *dilatata, rotunda* n. subsp.
   Divergent forms not accounted for by gradual depth-variation. Due probaby to specialization through isolation from main stock. Discriminating characters constant but not sufficiently distinct to warrant full specific rank.
4. *elongata,* n. sp.
   Origin as Nos. 2 and 3 but sufficiently distinct from No. 1 to warrant full specific distinction.
5. *ormesi,* n. sp.
   Quite distinct from all four above, but probably it and *dilatata* sprang from a common ancestor in the early Tertiary.

Group B.

6. *mandarina* (Duclos).
   Characters constant. Typical from the rocky littoral of southern New Zealand.
7. *adusta* (Philippi).
   Typical from rocky littoral of northern New Zealand. Shell thinner and less nodulous from deep water.
8. *adusta, mandarinoides,* n. subp..
   Typical in sandy and deep water northern localities. Occasionally intermediate forms (discussed below) indicate this form as a species in the making which can conveniently be given subspecific rank.

(4) Suggested Ancestry of Species.



Verconella dilatata (Q. & G.).

The original figure is obviously that of a juvenile, showing a very short canal. The type was dredged in 25 fathoms at the Bay of

Islands. A specimen, considered a typical adult, is here figured (Fig. 18) and compared with a typical 50 fathom shell, while following is a table showing the gradual change in proportion (diameter compared with height) as the depth increases. These shells compared from extreme depths also show differences in colour, weight and relative lengths of canal and spire, but as the variation is gradual bathymetrically all forms are connected in an unbroken series and it is impossible to separate the deep water shell even as a subspecies.

Typical 25 Fathom Shell.

Shell large, solid, canal short, slightly curved, widely open. Aperture + canal 0·365 times greater than height of spire (Sp. 1433). Inside of aperture smooth. Sculpture consisting of numerous very fine spiral lirae alternating with slightly stronger spiral riblets. Whorls nine and a half sharply angled at periphery with three stronger spiral ribs forming carina which is produced into horizontally compressed projecting nodules. The average specimens (Figs. 18, 20) have one of the spirals of the carina much the stronger but in occasional specimens all three ribs are of equal strength (Fig. 21), colour buff, interstices of riblets varying from light to darker reddish-brown with occasional axial streaks of same colour. Inside of aperture, canal and parietal wall porcellaneous white. Inner margin of outer lip showing small dark blotches caused by interstitial colour bands of exterior showing through callus of thin edge of lip.

Height 149 mm.; diameter 72 mm.; weight 2·529 ozs. *Cab. No. 1433.*

This form is common in the Hauraki Gulf, being representative of the 20-25 fathom area, and has been observed by the writer from Hen and Chicken Islands to Mayor Island in the Bay of Plenty.

An extremely large example recorded by Miss Mestayer (1924) from Farewell Spit, Nelson, is also quite typical. The dimensions were given as 257 mm. x 98 mm. but the exact measurements prove to be 210 mm. x 100 mm.

40–50 Fathom Shell.

Shell larger, thinner than typical species, coloured uniformly buff, without darker bands or blotches on outer lip. Whorls nine and a half, canal proportionately longer, not so open. Aperture + canal 0·492 times greater than height of spire (sp. 1435). Outer lip more dilated. Inside of aperture faintly lirate.

Height 167 mm.; diameter 79 mm.; weight 2·073 ozs.

Specimen figured (Fig. 19) from off Whakatane in 40–50 fathoms, in collection of Dr. C. E. R. Bucknill. (H. 159 mm.; D. 73 mm.)

Operculum (Fig. 1 of shell sp. 1435) is identical with that of shallow-water form; horny with nucleus terminal. Inside with a white callus along outer margin of muscle-scar. Outlines convex, pointed above. Heavy pad directly above, nucleus on inside.

100 Fathom Shell.

The Canterbury Museum specimen (Fig. 22) from west of Cape Runaway in 105 fath., measures 122 mm. x 50 mm., but as it is

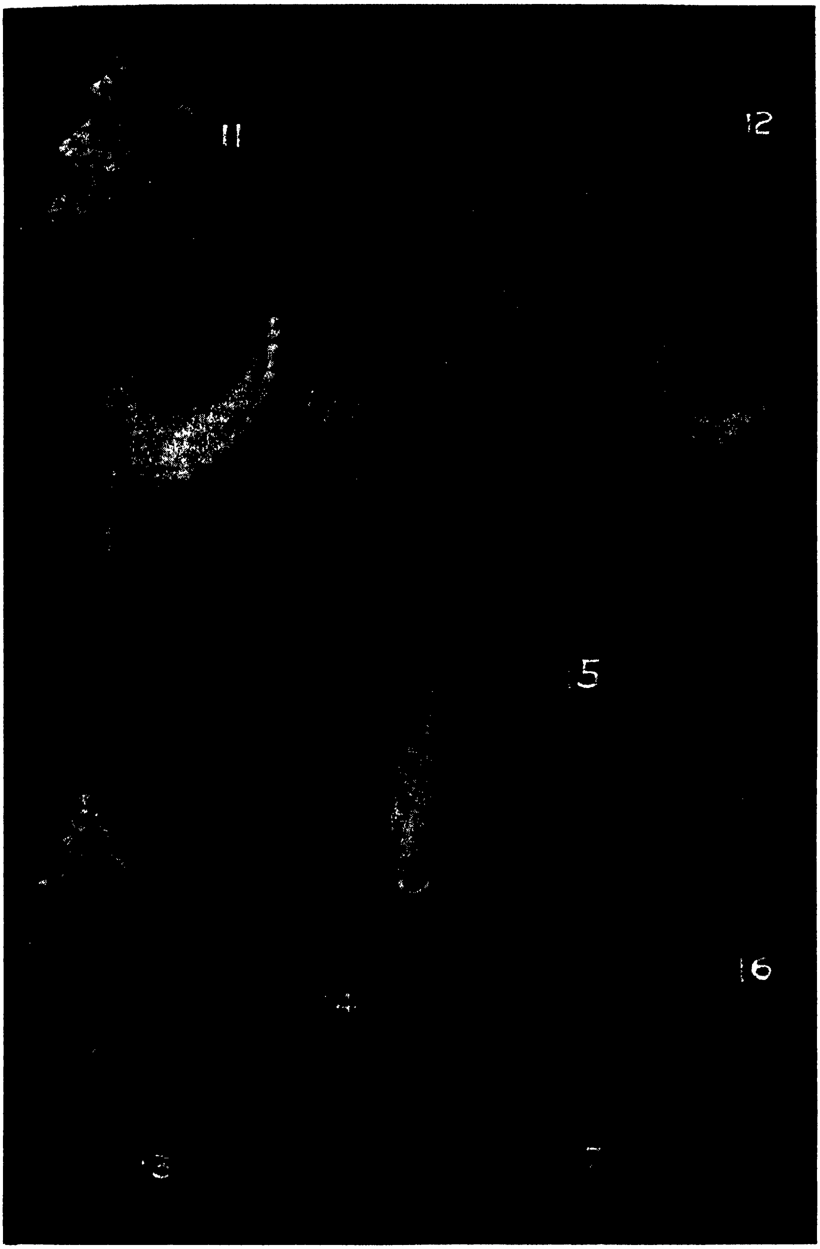


Fig. 11.—*Verconella dilatata* var. *rotunda* n. subsp. (holotype).
Fig. 12.—*Verconella dilatata* var. *rotunda* n. subsp. (paratype).
Fig. 13.—*Verconella dilatata* var. *cuvieriana* n. subsp. (holotype).
Fig. 14.—*Verconella dilatata* var. *cuvieriana* n. subsp. (paratype).
Fig. 15.—*Verconella ormesi* n. sp. (holotype).
Fig. 16.—*Verconella ormesi* n. sp. (paratype).
Fig. 17.—*Verconella ormesi* n. sp. (paratype).

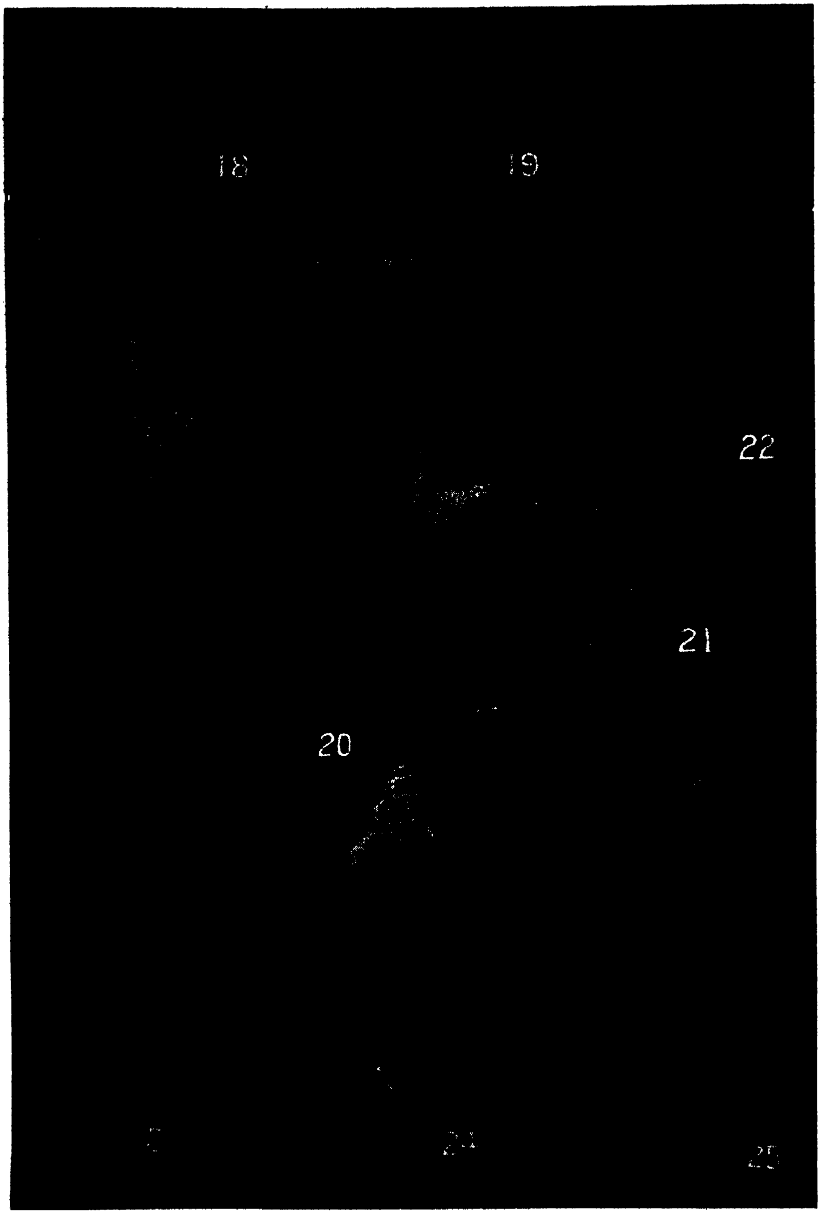


Fig. 18.—*Verconella dilatata* (Q. & G.) (25 fath. t;pical).
Fig. 19.—*Verconella dilatata* (Q. & G.) (40–50 fath.)
Fig. 20.—*Verconella dilatata* (Q. & G.) 18–20 fath. Whangarei
Fig. 21.—*Verconella dilatata* (Q. & G.) sp. 1431, 18–20 fath. Heads
Fig. 22.—*Verconella dilatata* (Q. & G.) (105 fath.)
Fig. 23.—*Verconella elongata* n. sp. (holotype)
Fig. 24.—*Verconella elongata* n. sp. (paratype).
Fig. 25.—*Verconella adusta* × *adusta* var. *mandarinoides* n. subsp. (hybrid).

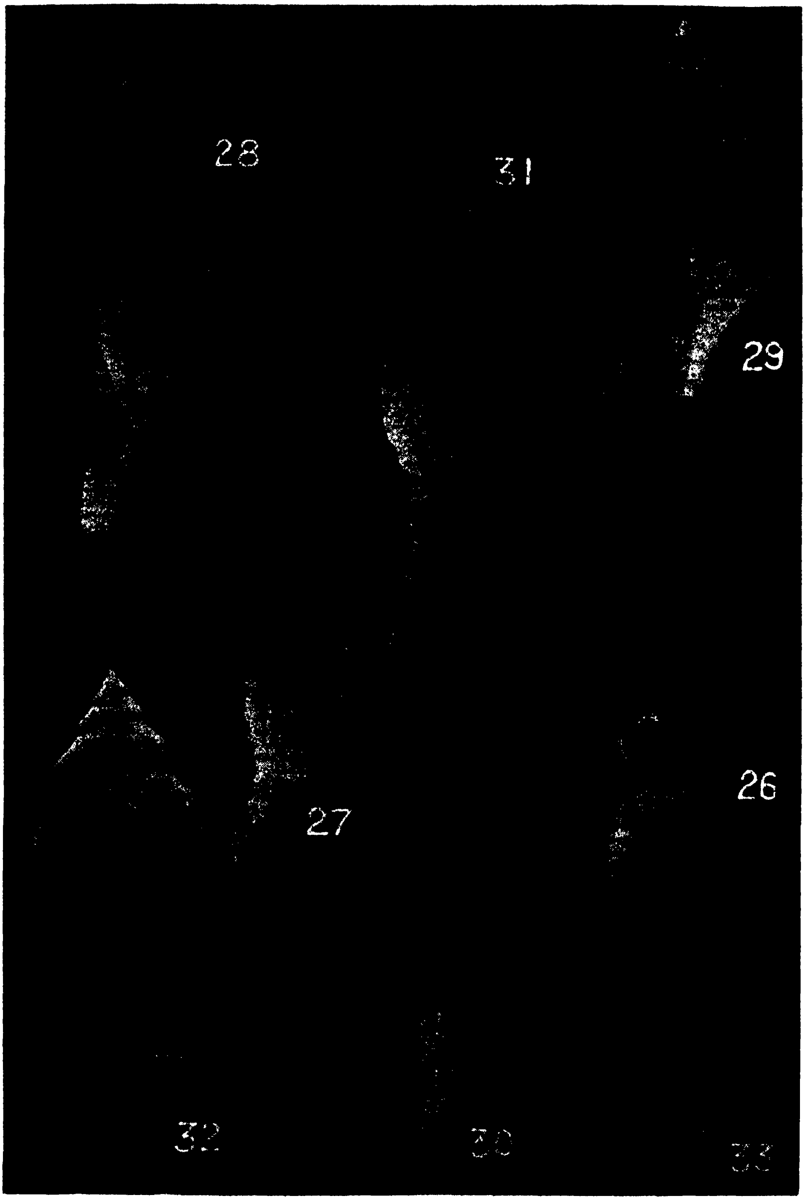


FIG. 26.—*Verconella adusta* (Philippi) 20 fath. Hauraki Gulf.
FIG. 27.—*Verconella adusta* (Philippi) 36–40 fath. Cuvier Island.
FIG. 28.—*Verconella adusta* (Philippi) 30 fath. off Whakatane.
FIG. 29.—*Verconella adusta* (Philippi) 10 fath. off Tryphena, Gt Barrier Island.
FIG. 30.—*Verconella adusta* (Philippi) littoral, Takapuna, Hauraki Gulf.
FIG. 31.—*Verconella adusta* var. *mandarinoides* n. subsp. (holotype).
FIG. 32.—*Verconella adusta* var. *mandarinoides* n. subsp. littoral, Mt. Maunganui.
FIG. 33.—*Verconella mandarina* (Duclos) littoral, Wellington Harbour.

minus the adult lip is not included below in bathymetric table. The peripheral keel is not so sharp—nor are the nodules as prominent as in shallower-water forms, but a series from depths intermediate between 50 and 100 fath. would no doubt show the same gradual variation as observed in the 18–50 fath. series.

TABLE OF BATHYMETRIC VARIATION.

Species	Height in mm.	Diameter in mm.	Proportions Diam. into Height	Depth in fathoms	Locality	Cabinet No.
dilatata (Q.&G.)	130	65	2	18-20	Tiritiri	1430
,,	143	71.5	2	18-20	Whangarei Heads	1431
,,	146	72	2·027	20-25	Off Cape Colville	1432
,,	149	72	2·067	25	Whangarei Heads	1433
,,	205 +3 for protoconch	100	2·08	27-30	Mayor Id.	1434
,,	167	79	2·114	40-50	Off Whakatane	1435
,,	164	76.5	2·143	40-50	Off Whakatane	1436
,,	210 +5 for protoconch	100	2·15	Cast up on beach	Farewell Spit	D.M.M. 1307
,,	159	73	2·178	40-50	Off Whakatane	
,,	157	72	2·181	40-50	Off Whakatane	1437
dilatata. cuvieriana n. sub. sp.	150	67	2·238	38-40	Off Cuvier Id.	1438
,,	136	59	2·305	38-40	Off Cuvier Id.	1442
dilatata. rotunda N. sub. sp.	150	72	2·083	25-30	Off Whakatane	1439
elongata n. sp.	134	55	2·436	19-20	Nr. Whale Id. off Whakatane	1440
,,	129	53	2·434	19	½ mile off Whale Island Bay of Plenty	1441

NEW SPECIES AND SUB-SPECIES.

GROUP A.

Verconella dilatata var. **cuvieriana** n. subsp. (Figs. 13, 14.)

Differs from typical species in being proportionately narrower (see bathymetric table) and stronger. Peripheral nodules strong but

blunt, very little compressed and not connected by sharp carina as in true *dilatata.* Periphery angled. Shoulder slightly concave. Adult lip not dilated. Colour buff; interstices of spiral sculpture obscurely lined with light brown. Aperture, interior of canal and parietal wall porcellaneous white. Margin of outer lip showing small dark-brown blotches caused by interstitial colour lines of exterior showing through callus. Protoconch damaged in both specimens.

Operculum (Fig. 2) horny, terminal nucleus inside with whitish marginal callus typical of *dilatata.* Differing from that of typical species in flattened upper outer slope, forming an angle of 52° with axis and also in the nuclear pad of the inside which is much less prominent.

Height 136 mm.; diameter 59 mm.; (holotype) (Fig. 13).

Height 150 mm.; diameter 67 mm.; (paratype) (Fig. 14).

Holotype and one paratype in Author's collection, Auckland.

Habitat: off Cuvier Island, Bay of Plenty, in 38–40 fath.

The slightly changed operculum proves morphological divergence indicated by shell characters.

Verconella dilatata var. **rotunda** n. subsp. (Figs. 11, 12).

Differs from the typical species in having the whorls more rounded, the periphery only slightly angled, the carina composed of several ribs of equal strength produced into squarish nodules, and the spire proportionately shorter. Outer lip of aperture dilated and marked with colour-blotches as in typical species. Colour-markings absent from 40–50 fathom shell. Operculum, protoconch, and number of whorls same as those of typical species.

Height 150 mm.; diameter 72 mm. (holotype) (Fig. 11).

Holotype and one paratype in Author's collection, Auckland.

Habitat: off Whakatane, Bay of Plenty, in 25–30 fathoms. (Type) also from 40-50 fath. off Whakatane.

This specialised form is the Eastern Bay of Plenty equivalent to the 20–25 fath. typical *dilatata* of the Hauraki Gulf and North.

So far, *rotunda* has been observed only from off Whakatane. Charts of the Bay of Plenty show a shallow-water connection of about eight fathoms between Matata and Rurima Rocks.

V. dilatata and its allies are never found in less than eighteen fathoms, so this shallow-water arm forms a natural division and barrier to the dispersal of the inshore fauna. Thus through partial isolation, east of the barrier, this new form is diverging from the ancestral type. As its differentiating characters are confined to the shell, the operculum not reflecting any morphological change, this form is indicated as a species in the making which can conveniently be classed as a sub-species.

No intermediate forms have been observed, and the differences in shell characters are readily distinguishable at sight. Occasionally

rotunda ranges down to 40–50 fathoms, a specimen being trawled alive together with the deep-water form of *dilatata* which, however, is directly related to the inshore typical *dilatata* from west of the barrier.

Verconella elongata n. sp. (Figs. 23, 24.)

Differs from *dilatata* in being proportionately much narrower with shoulder descending at a much sharper angle, canal straighter, outer lip not dilated and minus colour-blotches. Operculum distinct.

Shell large, solid, canal long, almost straight, narrowly open. Whorls nine. Protoconch of three and a half whorls, shaped as in *dilatata*. Height of spire and strength of peripheral nodules variable. Outer lip sinuous at shoulder, not dilated, lirate within, minus marginal colour-blotches, shoulder straight sharply descending, forming an angle of 30°–32° with vertical axis of shell (40°–50° at outer lip), in *dilatata* the angle is about 45° (55° at outer lip). Sculptured with numerous very fine spiral lirae alternating with stronger spiral riblets. Colour buff with the riblets light reddish-brown. Inside aperture and canal white, parietal wall whitish with light brown of body-whorl showing through. Operculum (Fig. 3) differing from that of *dilatata* in the flattened upper outer slope which forms an angle of 52° with axis. It is very close to the operculum of *dilatata cuvieriana* but in that species the nuclear pad of the inside is much less prominent than in *dilatata* and *elongata*.

Height 129 mm.; diameter 53 mm.; (holotype) (Fig. 23).

Height 134 mm.; diameter 55 mm.; (paratype) (Fig. 24).

Habitat: Quarter of a mile off Whale Island, Bay of Plenty, in 19 fathoms. (Type) near Whale Island in 19-20 fathoms.

As in the case of the preceding subspecies of *dilatata* the same factor of isolation from main stock seem to have caused the divergence of still another form, so distinct from *dilatata* that full specific distinction is warranted. This species has been obtained only from the vicinity of Whale Island, off Whakatane, in 19–20 fathoms. The shallow-water arm stretching from Matata to Rurima Rocks, mentioned above, is no doubt the direct cause of the divergence, the inshore Whakatane colonies being thus isolated from those west of the barrier.

Verconella ormesi n. sp. (Figs. 15, 16, 17.)

Shell very large, thin, canal short, slightly curved and widely open, spire tall. Aperture + canal 0·971 times greater than height of spire (holotype). Whorls eleven. Protoconch (Fig. 9) of four convex whorls, first four or five post-nuclear whorls axially costate and slightly keeled, succeeding whorls rounded, slightly appressed towards suture. Sculpture similar to that of *dilatata* consisting of numerous very fine spiral striae alternating with stronger spiral riblets. Aperture faintly lirate within. Outer lip thin, not dilated, slightly flexuous. Inner lip spreading as a thin callus across parietal wall and inner edge of columella. Occasional aged specimens with

thickened callus separated by groove from parietal wall. Colour uniformly pale buff, inside of aperture and canal porcellaneous white. Parietal callus whitish sometimes stained buff or brownish. The whole shell sometimes covered with a very thin, ochreus brown epidermis worn off in most specimens: *dilatata* never has an epidermis. In a few specimens peripheral angle reaches last whorl, but none has been observed with the axial ribs descending lower than the fifth post-nuclear whorl. Operculum (Fig. 4) horny with terminal nucleus, inside with whitish marginal callus typical of *dilatata* group. Differing from that of *dilatata* in the flattened upper outer slope forming an angle of about 52° with axis, and also in absence of a defined nuclear pad in the inside.

Height 201 mm.; diameter 75 mm.; (holotype) weight 1·818 ozs. (Fig. 15.)

Height 163 mm.; diameter 65 mm.;

Height 133 mm.; diameter 54 mm.; (paratype.) (Fig. 16.)

Type in Dominion Museum, Wellington.

A number of specimens trawled in 50–60 fathoms off Cape Campbell, Marlborough.

Group B.

Key to Species.

mandarina. Shell large, solid, whorls rounded, sculptured with very strong regularly spaced primary ribs and pairs of very fine interstitial riblets. Early whorls showing faint axial foliations absent from adult whorls. Canal short. Characters constant.

adusta var. *mandarinoides.* Shell very large, solid, but not heavy, whorls by nodulous keel. Sculptured with numerous spiral chords of varying strengths, and a variable number of fine interstitial riblets. Canal short. Details of sculpture variable, shape fairly constant. Operculum differing slightly in shape from that of *mandarina.*

adusta mandarinoides. Shell very large, solid, but not heavy, whorls rounded, sculpture rather fine consisting of crowded uneven spiral chords. Early whorls slightly angled, with a few axial foliations. Canal long. Operculum almost identical with that of *adusta.*

Verconella mandarina (Duclos).

As the location of the type of this species does not seem to be known and no definite locality was given for it at the time of description, a figure is provided in order to fix and represent the characters of the species. The figured specimen was obtained alive on the littoral shore in Wellington Harbour, and its distinctive characters are given in above key. Dimensions 90 mm. x 41 mm. (Fig. 33). Operculum (Fig. 5). The distribution of typical *mandarina* is now restricted to the South Island and southern shores of the North Island of New Zealand. A recent specimen in the Canterbury Museum from Wanganui represents the most northerly locality for the typical species known to the writer.

Marshall and Murdoch (1920) in their valuable paper on Tertiary rocks near Wanganui suggested that during the early Pliocene Cook

Strait must have been closed and a continuous beach must have extended from Kahurangi Point to the Wanganui area. This would effectively account for the occurrence of this and many other species of southern origin now found in the Wellington district.

Mandarina which is typical of the rocky littoral of the South is replaced in similar stations in northern New Zealand by the nodulous-angled *adusta.* In northern sandy and deep-water localities, a *mandarina*-like form has developed which, however, can be traced by the unequal inheritance of nodules and peripheral keel in some specimens to northern *adusta.*

In the light of modern evolutionary conceptions, it now becomes difficult to define a species, many apparently distinct types being bridged by the occasional occurrence of intermediate forms when bathymetric and littoral series from a variety of formations are brought together. As the extremes, however, represent the evolutionary forces at work, it is best to recognize extreme variation from the named type when comparatively stable as of sub-specific rank, being really species in the formation which ultimately with the combing out process of natural selection would probably become comparatively fixed forms or species.

The Northern *mandarina*-like shell, obviously derived from *adusta,* is therefore quite distinct from southern typical *mandarina,* to which species it bears only superficial resemblance; it is accordingly described below as a new sub-species, *adusta-mandarinoides,* none of the names attributed to the *mandarina* synonymy being applicable to the northern shell.

Environmental changes in this group evidently take considerable time to develop. In the Hauraki Gulf, *mandarinoides* is unknown, typical *adusta* ranging from the rocky litoral (Fig. 30) down to the sandy and muddy 20 fathom depths (Fig. 26). From off Cuvier Island in 36–40 fathoms, slightly modified forms of *adusta* (Fig. 27) are found, always with the axial sculpture and periphery angle fairly prominent. From Mercury Islands in 40–45 fathoms down to Whakatane in 40–50 fathoms, however, typical *mandarinoides* (Fig. 31) is mostly found. Only one specimen, referrable to *adusta* by the slightly angled periphery, was obtained from off Whakatane in about 30 fathoms (Fig. 28). In the Tauranga littoral *mandarinoides* is the common form (Fig. 32, 135 mm. x 64 mm.) which is found at certain periods breeding at the rocky Beacon Reef inside Tauranga Harbour. The Bay of Plenty being for the most part sandy, probably the advent of *mandarinoides* to rocky surroundings is of comparatively recent date, sufficient time not having elapsed to bring adaptive forces into play.

It seems quite evident that *mandarinoides* is the result of slowly-moving adaptive forces rather than that of spontaneous steps or mutations. These acquired changes, due to environment, appear to become transmittable, and an individual is not sufficiently plastic to be able, during its lifetime, to adapt or revert perceptibly to suit changing conditions. Consequently the association of *adusta* with

rocky shores and *mandarinoides* with sandy and deep-water locations in the north is not quite a hard and fast rule.

Probably hybridization also takes a part where the extreme types are brought into close proximity through the agency of the variable formations of the habitat. A specimen dredged with several *adusta* in ten fathom at Tryphena Bay, Great Barrier Island, appears to be a hybrid between *adusta* and *adusta mandarinoides* (Fig. 25).

Verconella adusta var. **mandarinoides** n. subsp. (Figs. 31, 32.)

Shell large, solid, canal long, slightly curved, rather open. Protoconch of two and a half to three whorls. Whorls ten. Body-whorl and sometimes penultimate covex slightly appressed towards suture. Upper post nuclear whorls only showing traces of axial foliations and peripheral keel. Sculpture rather fine consisting of crowded uneven spiral chords. Outer lip flexuous, not dilated, crenulated by spiral sculpture. Inner lip spreading as a callus over parietal wall and down inner edge of canal. Colour reddish-brown, the spirals darker. Inside of aperture, canal and parietal wall white. Operculum very similar to that of typical *adusta,* but with the nucleus less prominent (Fig. 7).

Height, 162 mm.; breadth 72 mm.; (holotype) (Fig. 6).

Height, 154 mm.; breadth 70 mm.; (paratype).

Holotype and one paratype in author's collection, Auckland.

Habitat: off Whakatane, Bay of Plenty in 40–50 fathoms.

Type: off Mercury Islands in 40–45 fathoms: Mount Maunganui, Bay of Plenty (littoral) (Fig. 32).

Literature Cited.

Finlay, H. J. 1924. The Molluscan Fauna of Target Gully. Part 1. *Trans. N.Z. Inst.*, vol. 55, pp. 495-516.

Hedley, C. 1920. On Siphonalia Dilatata of Suter's Manual, *N.Z. Journ. Sci. & Tech.*, vol. 3, p. 54.

Iredale, T. 1915. A commentary on Suter's Manual of N.Z. Mollusca, *Trans. N.Z. Inst.*, vol. 47, pp. 417-97.

Marshall, P., & Murdoch, R., 1920. Tertiary Rocks near Wanganui, *Trans. N.Z. Inst.*, vol. 52, p. 118.

On a Large Tonna and Two Other Gasteropods of Australian Origin.

By A. W. B. POWELL.

[*Read before the Auckland Institute 24th November, 1925; received by Editor, 29th December, 1925; issued separately, 8th February, 1927.*]

Plates 32, 33.

THAT our molluscan fauna has been reinforced during the Tertiary by Australasian elements has been shown by modern palaeontologists.

That Recent conditions are still favourable to the immigration of Australian species of certain types is indicated by the three species recently found in New Zealand, and recorded in this paper. All were obtained alive, one, the *Natica*, on three separate occasions, showing that these records are not based merely on accidentally-dropped shells or on other uncertain evidence.

So little is known concerning the life-histories of individual molluscan types that the importance of ocean currents as a means of dispersal cannot be disregarded. Palaeontological evidence (Finlay, 1925) dates the East Australian current, which sweeps southwards past New South Wales and Tasmania and then northwards along both coasts of New Zealand from about the late Pliocene.

Still another example of the efficiency of this current in bringing austral species to our shores is the finding of a living specimen of *Hydatina physis* (L.) at the Great Barrier Island (Powell, 1924).

Tonna tetracotula, Hedley *Rec. Aust. Mus.* vol. 12, no. 11, p. 332, pl. 42-43, Figs. 4-5, 1919.

A single specimen of this handsome species, almost eight inches in height, was trawled alive somewhere near the entrance to the Hauraki Gulf or western Bay of Plenty, and is now in the writer's collection. (Fig. 1.) Unfortunately exact particulars regarding depth and locality are not available, but the specimen undoubtedly came from New Zealand waters; and furthermore, the writer has seen in the possession of a local fisherman, one other specimen alleged to have been trawled in vicinity of Cape Colville in 25 fathoms. The type is from off Green Cape, New South Wales, in 40-80 fathoms and measures 198 mm. (height), 150 mm. (major diameter), and 117 mm. (minor diam.) with weight of eight ounces. The New Zealand specimen measures 200 mm. (height), 157 mm. (major diameter), and 122 mm. (minor diam.), with weight of only five ounces. Apart from being a lighter and a thinner shell, however, the New Zealand specimen is identical with the typical New South Wales species. The New Zealand specimen is coloured uniformly light orange-brown, paler towards suture. Hedley mentioned that sometimes three spiral bands of hazel brown are present, but these are absent in the New Zealand specimen.

From *Tonna cerevisina* var. *haurakiensis* Hedley = (*T. variegata* of New Zealand authors), *T. tetracotula* differs by the presence in each main groove of an interstitial riblet, and also in absence of colour pattern, larger and thinner shell, in having a dark-brown protoconch, and the columella much more twisted, with the bridging parietal callus concave leaving a very narrow crescentic umbilicus. *T. cerevisina haurakiensis* has a pink-coloured protoconch, and the parietal callus is convex leaving an open rounded umbilicus.

Cymatium waterhousei (A. Adams & Angas) *Proc. Zool. Soc. (Lond.)* 1865, p. 35.

The figured specimen (Fig. 2) measuring 52 mm. x 30 mm., was obtained alive at low water at Parengarenga, New Zealand, by Mr. W. La Roche. The type is from Port Lincoln, South Australia. The species has not previously been recorded from New Zealand, but is represented in the author's collection from Albany, Western Australia, and Sunday Island Kermadec Island, and has been recorded from Tasmania and quite recently from New South Wales in 30 fathoms (Iredale, 1925).

Cochlis migratoria n. sp. (Figs. 3, 4, 5, 6).

Natica gualteriana of Australian authors. Shell small, semi-globose, fairly solid, polished; spire low, about one-third height of aperture; funicle large leaving at junction with parietal wall a a narrow crescentic groove which terminates above in very small rounded umbilicus. Whorls five, smooth, polished, except on shoulder, which is sculptured on all adult whorls with close fine furrows, radiating from suture. Suture abutting. Protoconch minute, depressed, of one and a half whorls. Ground-colour greyish-white; protoconch reddish-brown; early post-nuclear whorls and broad sutural band, white; body-whorl with four narrow spiral bands of chestnut or purplish-brown; upper two sometimes fused into one broad band; funicle and parietal callus pale-rose, stained darker in places, mostly along edge of parietal callus and umbilical margin of funicle. Operculum typical of *Cochlis* with single marginal sulcus, rather thin and flat, exterior glistening white, interior with yellowish polished horny epidermis.

Holotype in author's collection, Auckland.

Height in m.m.	Diameter in m.m.	
15	14·5	(holotype)
15	13·5	(paratype)
17·5	15	(Awanui Heads sp.)
12·5	12	(Shellharbour, N.S.W., Fig 6)
15·5	15·5	(Shellharbour, N.S.W.)

Parengarenga Harbour, New Zealand (collected alive, half concealed in sandy mud at low tide by Mr. W. La Roche)*, June 1925; Awanui Heads, New Zealand (Collected by W. La Roche) April 1925; Shellharbour, New South Wales (A. E. J. Thackway); Norfolk Island (C. L. Wragge).

*Mr. La Roche has since collected, after a gale, about 20 specimens, cast up on the beach in Parengarenga Harbour.

Fig. 1.—*Tonna tetracotula* Hedley.

FIG. 2.—*Cymatium waterhousei* (A. Adams and Angas).
FIG. 3.—*Cochlis migratoria* n. sp. (holotype).
FIG. 4.—*Cochlis migratoria* n. sp. (paratype).
FIG. 5.—*Cochlis migratoria* n. sp. (Awanui Heads).
FIG. 6.—*Cochlis migratoria* n. sp.. (N.S.W., Australia).
FIG. 7.—*Cochlis gualteriana* (Recluz) (Hawaiian Is.).

Hedley (1913) ascribed the New South Wales shells previously recorded as *Natica marochiensis*, Lamk., to *N. gaulteriana*, Recluz, and the following notes were published by him after study of type-material in the British Museum (Natural History).

"In the British Museum at least two species are exhibited as '*maroccana* chemnitz' or '*maroccana* var.' There is a tablet with five specimens labelled '*maroccana* Chemnitz, Cape York, N. Australia, J. B. Jukes, *Natica marochiensis*, Lamk. *Voy. Ast.*, t. 66, f. 16.' This has a low spire, radial furrows on the shoulder and the operculum of *Cochlis*, i.e., with a single marginal sulcus. Again there are three specimens from Senegal and three from River Gambia, ... which although called by the same name as the Cape York series, differ by having a higher spire, finer shoulder wrinkles and the operculum of *Natica*, i.e., spirally sulcate.... With the Cape York shells, there also agrees a set of three labelled '*Gualteriana*, Pet., from Isle of Bohol, M.C.' Though these are not marked types, I have some ...nce in regarding them as the originals of Reeves figure, and ...d description of Recluz, which differs in minor details ... Even the error of Cumings' clerk, in misquoting the ...ne author of the species supports their authenticity."

...nting this, '*maroccana*' or '*marochiensis*' may be reserved, ...name implies for an African species; while the Australian ..... should be referred to *gualteriana*."

The specimen figured (Fig. 7) measuring (Ht. 14·5 mm., Diam. 15 mm.) from Pearl City, near Honolulu, Hawaiian Island, is considered by the writer identical with the Philippine Island *gualteriana*. *Gualteriana* by Reeve's figure (1855) and specimen quoted above has the same type of radial furrows on shoulder as in *migratoria* n. sp. but differs in the colour bands being broken up into rectangular dots, the parietal callus not being coloured, and the funicle being much smaller, leaving a much larger umbilical area. The operculum, however, presents the most difference, being much thicker and heavier than that of *migratoria*, with exterior noticeably convex and not nearly so pointed above. In the three specimens examined from Hawaiian Islands these characteristics are quite constant, so the writer has no hesitation in separating the temperate shells from the tropical *gualteriana*.

The British Museum specimens from Cape York, examined by Hedley, are no doubt true *gualteriana*, but all the Australian temperate specimens the writer has seen are referrable to the n. sp. *migratoria*.

No doubt with careful collecting many regional forms of this series will be found in the South Pacific. Several specimens from Tahiti and others from Rarotonga in the writer's collection are both separable at sight from either *gualteriana* or *migratoria*, but are nearer to the first named species.

Dall (1892) explains that in most species of *Natica* and allied genera the shape of the shell varies slightly according to sex. Males

have a smaller and less-inflated shell, not having to carry the large egg-sac of the females. Apart from this sexual variability, New South Wales and Norfolk Island specimens are inseparable from the New Zealand species.

Bolten's genus *Cochlis* (Museum Bolten 1798, p. 146; Types *C. albula*, Bolten) is in this paper given full generic status, as the two series *Natica* and *Cochlis* have quite distinct opercula; and both genera now share a wide Recent distribution so are evidently of considerable age geologically. All the New Zealand Recent and Tertiary Naticoids with calcareous opercula are *Cochlis*, but in Australia, Florida, and many other parts of the world, both *Natica* and *Cochlis* are found together.

Literature cited.

DALL, W. H., 1892. *Tertiary Mollusks of Florida.* *Trans. Wagner Free Inst.*, vol. 3, pt. 2, p. 362.

FINLAY, H. J., 1925. *Some modern conceptions applied to the Study* ... *Cainozoic Mollusca of New Zealand.* *Overg. Gedenboek* ... *Geol. Nederland en Koloniem, Geologische Serie*, Deel ...

HEDLEY, C., 1913. *Studies on Australian Mollusca*, Part 11. *P*... *Soc. N.S.W.*, vol. 38, pt. 2, pp. 298-299.

HEDLEY, C., 1919. *A Review of the Australian Tun Shells.* *Rec. A*... vol. 12, No. 11, pp. 331-332.

IREDALE, T., 1924. *Results from Roy Bell's Molluscan Collections.* *Linnean Soc. N.S.W.*, vol. 49, pt. 3, p. 254.

IREDALE, T., 1925. *Mollusca from the Continental Shelf of Eastern Australia* *Rec. Austr. Mus.*, vol. 14, No. 4, p. 261.

MARWICK, J., 1924. *The Tertiary and Recent Naticidae and Naricidae of New Zealand.* *Trans. N.Z. Inst.*, vol. 55, pp. 545-579.

POWELL, A. W. B., 1924. *Notes on New Zealand Mollusca.* *N.Z. Journ Science & Tech.*, vol. 6, Nos. 5 & 6, p. 284.

REEVE, L., 1855. *Conchologia Iconica*, vol. 9, pl. 25, f. 114.

Literature Cited.

SUTER, H., 1913. *Manual of the New Zealand Mollusca*, p. 314.

A New Genus and Three New Species of Coleoptera.

By Albert E. Brookes.

[*Read before the Auckland Institute, 24th November, 1925; received by Editor, 28th November, 1925; issued separately, 8th February, 1927.*]

Suborder ADEPHAGA.
Superfamily Caraboidea.
Family Carabidae.
Subfamily Harpalinae.
Genus *Cillenum.*
4332. *Cillenum tillyardi.*

Suborder POLYPHAGA.
Group Lamellicornia.
Superfamily Scarabaeoidea.
Family Lucanidae.
Subfamily Dorcinae.
Genus *Lissotes.*
4333. *Lissotes mangonuiensis.*

Group PHYTOPHAGA.
Superfamily Cerambycoidea.
Family Cerambycidae.
Genus *Neocalliprason.*
4334. *Neocalliprason elegans.*

CARABIDAE.

Cillenum Samouelle, 1819, *Ent. Comp.* ed. 1, p. 148.

Cillenum tillyardi n. sp.

Nitid, elongate, convex, body testaceous, thorax darker; head, tips of mandibles, and a narrow portion of front of thorax and basal margin picious. *Head,* hardly as broad as thorax, smooth, with inter-ocular depressions; eyes large and prominent. *Thorax* as broad as long, sides rounded, marginate, widest just before the middle, narrowest behind, a little incurved apically, base subtruncate, with a transverse depression, disc with a distinct median line, and a faintly raised semicircular ridge just behind the apex; lateral margins with two setigerous punctures on each side, one a little in front of the middle, the other near the posterior angles. *Elytra* two and one-third times as long as thorax, elongate-ovate, widest at middle thighs, broadly rounded and slightly narrowed to apices, interstices flatly convex, striae shallow with feeble punctures, the third interstice with two fuscous setigerous punctures on each side. *Legs,* anterior tibia moderately stout, median and posterior slender, all bearing pallid hairs, and also the tarsi, tibial spurs long and slender.

Holotype, male, length 4 mm., breadth 1·4 mm.

Allotype, female, length 3·9 mm., breadth 1·3 mm. In collection, Cawthron Institute, Nelson.

Paratypes in author's collection.

Material: Five specimens from Dr. R. J. Tillyard, Chief of the Biological Department, Cawthron Institute, Nelson, whose name it bears.

Locality: Tahuna, Nelson, among sandhills, Jan. 1925.

Remarks: This is a distinct species, and can readily be separated from *C. chalmeri* (No. 1568), its nearest ally, by its longer thorax and more flatly rounded elytra. The elytral markings vary considerably, some specimens having four punctures on one side and only two on the other, and may also have a feeble fuscous patch surrounding the posterior punctures.

SCARABAEIDAE.

LISSOTES Westwood, 1855, *Trans. Ent. Soc.* n. ser. 3, p. 213.

Lissotes mangonuiensis n. sp.

Elongate-ovate, shining, broadly convex, very dark brown, head and elytra with slight metalic reflections, legs rufescent. *Head*, moderately coarsely punctured, the punctures around the eyes more distant and larger, widely depressed betwen the eyes, deep in front, gradually becoming shallower behind; forehead inwardly curved leaving the front prominent and subacute; sides regularly curved backwards; eyes not prominent, hardly projecting beyond the thoracic margins. There are two small elevations near the front angles, one on each side. *Antennae* with basal joint picious, remaining joints fuscous, with inner portion of club lighter. *Mandibles* short and broad, tridentate, left with the two lower large, transversely projecting, and narrowly separated, right with middle tooth small and situated high up, closing above the top of middle left, lower one closing between the middle and lower of left. *Thorax* finely distantly punctate, one and a half times broader than long, sides rounded, marginate, very little constricted behind, apex slightly convex, front angles prominent with a small depression, base truncate, marginate, hind angles subquadrate, disc a little depressed longitudinally. *Elytra* one and two-thirds as long as thorax, shoulders a little roundly produced forward, sidessub-parallel to hind-thighs, then broadly rounded to apices, their whole surface densely punctate, also with indistinct rugose sculpture, inter-stitial striae not very distinct but marked by larger and deeper punctures; there are also a few light-brown erect scales along the sides and near the apices, where they are more prominent. *Legs* stout, anterior tibia carinate and grooved, and armed outwardly with five teeth, lower ones large, others small, other tibia with extremities produced, forming a bifid tooth, and bearing externally a small one about the middle.

Holotype, male, length (excluding mandibles) 11 mm., breadth 4·9 mm.

Allotype, female, length (excluding mandibles) 10·8 mm., breadth 4·8 mm. In author's collection.

Material: A single pair, found by the author.

Locality: Oruru, Mangonui, North Auckland, under a log, 9th September, 1918.

Remarks: The female differs very little from the male, antennae of about same proportions, mandibles not quite so long or stout, right with a bifid tooth below the middle, closing in front of middle and lower of left. The nearest allies of this species are *L. abditus* (No. 1175) which has the front angles of head convexly rounded into the

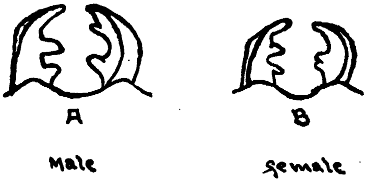


FIG. 1.—Mandibles of *Lissotes mangonuiensis* × 4.

frontal depression, and the whole surface more coarsely punctate. In *L. stewarti* (No. 1174) the posterior sides of thorax are obliquely constricted, with head and sculpture similar to the preceeding. In both these species the frontal depression of head does not extend back beyond the front line of the eyes, where, as in the species now described, it nearly reaches the base.

CERAMBYCIDAE.

NEOCALLIPRASON n. gen.

Head slightly oblique, rather deeply depressed between antennae, of same width as widest part of thorax, narrowed behind. *Eyes* prominent, deeply broadly notched above, not coarsely facetted, subreniform. *Antennae* with the basal joint stout, moderately long, swollen towards the extremity, also the third and fourth. *Thorax* uneven, armed with two lateral and two dorsal tubercles, constricted before the middle and at base. *Elytra* slender, gradually narrowed for half their length then subparallel, lateral margins slightly inwardly curved. *Legs* slender, elongate, femora a little gradually swollen towards extremities. This is another allied genus of the *Callipraso*n group, differing from *Callipraso*n by the deeply-notched eyes, antennae, and form of thorax; from *Pseudocallipraso*n by the less-coarsely facetted eyes, shorter and broader thorax, and form of head which is subparallel behind the eyes.

Genoholotype, *Neocallipraso*n *elegans* n. sp.

Neocalliprason **elegans** n. sp.

Head picious, *thorax* and base of femora rufous, *Elytra* very dark brown, nearly black, with yellow longitudinal stripes. *Head* of moderate size, widest in line with antennae, broadly roundly constricted to width of base of thorax, leaving a narrow parallel portion at base, dorsal depression extending from front to base where it becomes shallower, muzzle subquadrate, with a raised margin, surface irregularly punctate. *Antennae* more than twice the length of elytra, basal joint stout, second very short, third and fourth subequal, fifth longer than second and third combined, only slightly swollen at apex, sixth to tenth about equal, subparallel, eleventh a little shorter than

the preceding; the first five joints almost black, the following three dark brown, ninth pale yellow, tenth and eleventh tawny. *Thorax* with the apical portion of same colour as head, other portion of a deep rich-red, lateral margins bearing fine, silky, pallid clothing, the frontal portion is slightly widened and then roundly constricted to immediately in front of the lateral tubercles which are broadly acute, their points not projecting beyond the base of elytra, disc very uneven, depressed in front and behind the dorsal prominences, which are broadly rounded terminating in a rounded ridge on basal edge, with a slight depression in front, surface shining with a few punctures, frontal margin subtruncate, base bisinuate, *Elytra* dull, elongate, narrowed behind, shoulders rounded, a little raised, outer margins inwardly curved and distinctly margined, apices individually obliquely rounded, the surface on the basal third distinctly punctate with rugose sculpture, each elytron with two bright yellow marks, a large oblique one starting between the shoulder and suture, leaving a narrow space around the scutellum, and joining the suture just below, and then becoming half the width of oblique portion, and continuing along the sutural margins to apices, the other situated immediately below the shoulder, short, broad in front and gradually diminishing to hind thighs where it ends, each elytron with three not very distinct narrow costae; the whole surface is clothed with fine close vestiture, that on the yellow portion being longer and more conspicuous. *Legs,* femora for nearly half their length dark-red similar to thorax, apical portion a dark-purplish tinge, moderately swollen, tibia of same colour as lower portion of femora, long and slender, and armed with two short apical spurs, and bearing numerous fine hairs. *Tarsi,* anterior and median light-brown, posterior light-yellow, basal joint long, second only half the length of first, third shorter than second, deeply bilobed, fourth long and slender. Underside, metasternum, abdomen, head and thorax picious, clothed with short recumbent ash-coloured pubescence, posterior coxal processes orange.

Holotype, male length approx. 11 mm., breadth approx. 2 mm.

Allotype, female, length 16 mm., breadth 3·5 mm. In author's collection.

Female, colouring similar to male, antennae shorter, about one and a half times longer than elytra, apical ventral segment exposed, not covered by elytra, underside of abdomen marbled with orange.

Material: A singe pair, taken by Mr. T. R. Harris, to whom we are indebted for this fine and evidently rare species.

Locality: Ohakune, Main Trunk Line, taken off ferns at night.

Remarks: The holotype has the wings spread, so that the measurements given can only be approximate; the allotype is unfortunately a little mutilated.

The Veneridae of New Zealand.

By J. MARWICK, M.A., D.Sc.

[*Read, by permission of the Director of the N.Z. Geological Survey, before the Wellington Philosophical Society, 13th June, 1923; received by Editor, 10th December, 1925; published separately 12th February, 1927.*]

PLATES 34-54.

CONTENTS.

REFERENCES.

PART 1. INTRODUCTION.

PERHAPS in no other family of the Mollusca is it so difficult to reconcile the classifications and nomenclatural systems of different authors as in the Veneridae. This is a stumbling block to New Zealand conchologists who, owing to the lack of extensive foreign collections and of a large proportion of the older literature, have to depend on quotations, often without figures, for much of their information. As to the generic grouping of species, no great difficulty is presented by the shells of this country, so that if one could start with a set of new generic names the task would be a light one. This procedure, however, would conceal the resemblances which our Veneridae show to those of other countries, and valuable information as to faunal origins and migrations might be overlooked. Therefore in the following classification an attempt has been made to preserve such external relationships as are considered close, without making any undue sacrifice of accuracy.

In the diagram given by Suter (1913, p. 827) to illustrate the parts of a Venerid shell, the posterior cardinal tooth has, by a slip, been labelled "posterior lateral," also several characters commonly

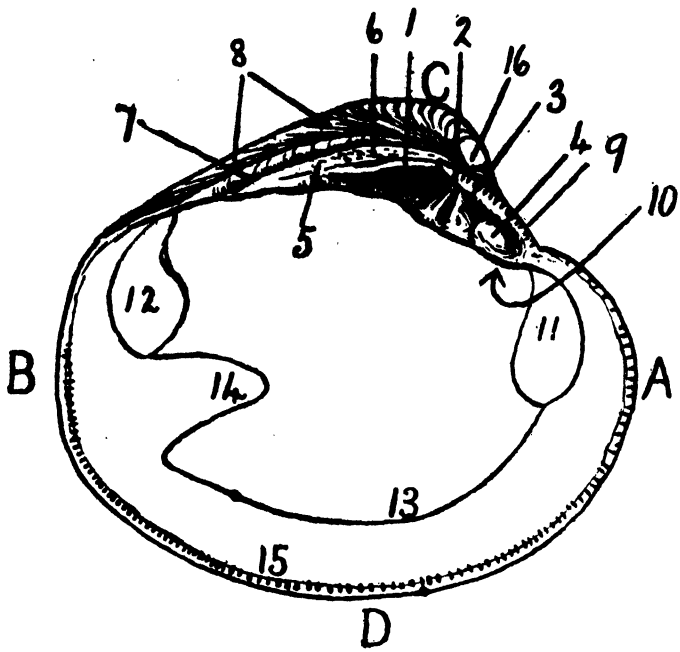


FIG. 1.—Diagram of the left valve of *Kuia vellicata* (Hutton) x 3.

used in descriptions are not indicated. Consequently the following revised diagram is given.

A, anterior margin
B, posterior margin
C, dorsal margin
D, ventral margin
A-B, length
C-D, height
1, posterior cardinal tooth
2, median cardinal tooth
3, anterior cardinal tooth
4, anterior lateral tooth
5, nymph
6, resiliary surface of nymph
7, ligamental groove
8, escutcheon
9, lunule
10, pedal retractor scar, out of sight under the hinge plate.
11, anterior adductor scar
12, posterior adductor scar
13, pallial line
14, pallial sinus
15, marginal crenulations
16, umbo

The chief modern students of the Veneridae have been Dall (1903), Jukes-Browne (1908-1914) and Cossmann and Peyrot (1911). These writers disagree greatly not only in the relative evaluation of shell characters, but also in the application of the Rules of Nomenclature. Dall has consistenty advocated a strict observance of the International Rules, and always supplies references to the literature, therefore he is the most reliable guide.

Suter, in his Manual (1913) followed Dall's classification almost completely; and although several necessary changes were pointed out by Jukes-Browne and Iredale, he did not accept them in his subsequent works on the Tertiary Mollusca (1914–1921).

In the primary division of the family into subfamilies the tendency seems to have been to err on the side of conservatism. Deshayes (1853) recognised four subdivisions, Dosiniana, Meretriciana, Venusiana and Tapesina. Fischer (1887) favoured only three, merging the Dosiniinae with the Meretricinae. Dall again separated the Dosiniinae, but united the Tapetinae with the Venerinae and recognised a further subfamily, the Gemminae (with which we in New Zealand are not directly concerned). Jukes-Browne argued that the Dosiniinae were no further removed from the Meretricinae than the Tapetinae were from the Venerinae, and so recognised only two subfamilies Meretricinae and Venerinae. This tendency to restrict the number of subfamilies probably arose from the difficulty of drawing sharp boundaries, defined in a few words, between the proposed divisions. There has also been some divergence in the principles governing these systematic classifications.

The writer is inclined to think that the division of the Veneridae into at least seven or eight subfamilies would agree better with the relationships displayed, but this subject requires a great deal more research before conclusive opinions can be formed. In the present paper the Dosiniinae are kept apart from the Meretricinae and the Tapetinae from the Venerinae. There may be difficulties in defining these groups concisely, but the guiding principle should be relationship, not ease of definition.

Acknowledgments.—To all those who so kindly supplied information and who lent or gave Venerid specimens the writer is deeply indebted.

PART 2. STRATIGRAPHICAL AND BIOLOGICAL REMARKS

(a) EXTERNAL RELATIONS OF N.Z. VENERIDAE.

Before a trustworthy history of the elements of our Venerid faunas can be written, much more research must be done on the classification and on the present and past distribution of the family in other parts of the world. Nevertheless it may be useful to set down such evidence as the writer has been able to gather in the hope that criticisms will provide us with better information. Differences of opinion on the interpretation of the evidence are likely. For instance, *Notopaphia, Irona* and *Tuangia* have not been collected from our Tertiary Rocks. What then was their origin? Did they arrive in the New Zealand region after the Pliocene; or have their direct ancestors been living in these seas during the Tertiary, and their shells not been preserved owing to a habitat unfavourable for fossilization? Other interesting questions are whether the Recent *Chione (Austrovenus) stutchburyi* is more closely related to *Chione (Hinemoana) acuminata* Hutton from the Pomahaka beds or to such Californian species as *C. fluctifraga* (Sowb.), *C. californiensis* (Brod.) and *C. nuttalli* (Conrad), and where and when the different stocks diverged from their common ancestor.

The subfamily Venerinae to which most of the highly-ornate and marginally-crenate species belong has not been found anywhere in the Cretaceous. What is the history of its present almost world-wide

distribution? This cannot be convincingly answered until we find out more about the life histories of the different species, and, given favourable currents and water temperatures, what distance of ocean they could cross. Records of a species from two faunal regions should be examined in the light of a possible convergence; but in a family like the Veneridae, convergence is probably uncommon because so many coincidences are involved; such as do occur will be found among genera with a simple sculpture.

Parallelism, or the development of two related stocks along similar lines may explain many of the resemblances which have been noted betwen New Zealand shells and those of other regions; but this explanation only puts the common origin a little earlier in time; it does not do away with the need of explaining how the two stocks acquired their present distribution.

The following is a rough outline of the history and affinities of Venerid genera that have been collected recent and fossil in New Zealand.

In its broad sense, *Dosinia* has existed in New Zealand waters throughout the Tertiary, and though no true representatives have been recorded from our Cretaceous, they will probably yet be found. *Dosinia* does not occur in the Northern Hemisphere until the Aquitanian, *i.e.*, Lower Miocene, so von Ihering's statement that the subfamily originated in an Antarctic continent of Upper Cretaceous times and spread from there northwards in the Tertiary is very likely correct. Several of the subgenera such as *Austrodosinia, Raina,* &c. seem to have originated in New Zealand; but the writer has not had access to Australian or South American specimens for detailed comparisons. Tate (1887, p. 161) recorded *Dosinia greyi* from Edithburgh, St. Vincent Gulf, and although the specific identity might not now be upheld, it is possible that the shell is a *Kereia*. *Phacosoma* is a Japanese subgenus of which the earliest known occurrence in New Zealand is from the Lower Pliocene of Wanganui district.

The new genus *Finlaya,* from the Wangaloa beds, appears to be related to *Dosiniopsis,* founded on an Eocene fossil from the Eastern United States. *Dosiniopsis* occurs also in the Eocene of the Paris and London Basins and (fide Jukes-Browne) in the Upper Cretaceous of England. Obviously the distribution must have been very much wider and remains to be revealed, or we have a remarkable case of convergence combined with coincidence in time. The Wangaloa Beds from which the New Zealand species comes are probably Paleocene.

Upper Cretaceous rocks of almost every country furnish shells of the *Callistina* group. Therefore it is not surprising to find a close relative in *Tikia* which probably came to these shores from the north-west.

Paradione occurs typically in the Parisian Eocene, but similar shells are wide spread throughout the Tertiary. The New Zealand and Australian members are regularly finely striated, as in the young *Paradione,* so they probably branched off at a somewhat earlier stage than is represented by the adult type species. For these southern forms Iredale has proposed the genus *Notocallista,* which is here given only subgeneric rank.

Hyphantosoma: Apart from the unusual sculpture the New Zealand shell agrees closely in shape and details of hinge with the typical Jamaican ones. Perhaps *Hyphantosoma* reached our shores along with *Chione* and *Protothaca*.

Marama, Hina, Kuia, and *Dosinula* belong to the *Antigona* group of genera, the distribution of which is difficult to ascertain because these shells are often classed as *Chione*, and many authors do not figure the hinge. They are certainly widely spread in present Indo-Pacific and European seas and have been recorded from the Tertiary of a still wider area. The foreign genus most closely resembling the New Zealand genera is *Ventricoloidea* which appears first in the Oligocene of Europe, but the evidence we have is insufficient to show the connexion between them.

Bassina occurs in the Recent seas of New Zealand, Tasmania, and south-eastern and southern Australia. It has been found in the Lower Pliocene of Victoria and South Australia and in the Lower Miocene (and probably the Oligocene) of New Zealand.

The New Zealand example of *Clausinella, C. morgani*, is by no means typical. Its sculpture and shape are the same as those of *C. thiara* (Dillwyn) from the Philippines and Queensland. The hinge, however, is more arched, and the teeth are shorter than in *C. fasciata* the genotype, and the lunule, as in *C. thiara*, is bounded by a groove. The young *thiara* and *morgani* have distant thin concentric lamellae like *Bassina calophylla* (Philippi), but the young *fasciata* is almost smooth with fine concentric grooves resembling *Chamelea*. Judging from the sculpture and the incised lunule the New Zealand fossil and *C. thiara* are more closely related to each other than to *C. fasciata*, but the hinge of *C. thiara* agrees with that of *fasciata* while *morgani* is slightly different.

The exact relationships, however, cannot yet be made out. *C. fasciata* has no well-defined ancestral line in the Tertiary of Europe and may be a recent arrival there. *C. dertoparva* Sacco from the Miocene was cited by Jukes-Browne as an ancestor, but it has an anterior lateral tubercle and so belongs rather to *Artena*.

Tawera is common in New Zealand, the south-eastern part of Australia, Tasmania, Chatham Islands, Auckland Island, and Macquarie Island. Von Ihering (1907, p. 297) stated that *Chione gayi* Hupé from Magellan Straits and Chile is "intimmement relationee à la *Ch. mesodesma* Q. & G. de la Nouvelle Zelande" and Smith (1885, p. 131) identified as *C. mesodesma*, a shell dredged from Station 135E 1000 fathoms, off Tristan da Cunha. This last record, however, is surely a mistake; for the genus elsewhere is a shallow-water one. It is incredible that the New Zealand species should occur at 1000 fathoms in the Atlantic when its home is under the 50-fathom mark in New Zealand.

Early fossil occurrences of the genus are *Tawera propinqua* (Tate) from the Balcombian (Oligocene) and *T. marshalli* from the Awamoan (about Lower Miocene) of Target Gully.

The small shells which have here been given the name *Turia* may form a connecting link between *Kuia* and *Marama* on the one hand and *Tawera* on the other, for the left anterior cardinal is intermediate

in the degree of its forward extension. If this is so the process seems to have been one of a reduction of the anterior lateral tooth, for *Tarama* and *Turia* first occur much earlier than *Tawera*.

Austrovenus possesses so much in common with species of *Chione* s. str. from the West Indies, Central America and California that there can be no doubt that they owe this to a common origin. The stocks of each region have probably not had any connexion for a very long period, because several of the chief characters of *A. stutchburyi* are distributed over a number of American species. *Chione* has existed in the West Indian–Californian area since the Oligocene but the earliest known *Austrovenus* appears in the New Zealand Pliocene. The related *A. (Hinemoana) acuminata* (Hutton) from brackish-water beds in Otago, of perhaps Oligocene age, has a posterior lateral tooth and very fine concentric ornamentation, so that it is probably an offshoot from the main line of descent. It shows, however, that relatives of *Chione* and *Austrovenus* were living in New Zealand waters early in the Tertiary.

Eumarcia and *Atamarcia* have close relatives in Australia and in South America, and have probably been in these areas and in New Zealand since Cretaceous times.

The name *Cyclorismina* has been introduced for an Upper Senonian fossil from Selwyn Rapids which resembles *Cyclorisma oldhamiana* Stoliczka from the Trichinopoly group of India.

The new subgenus *Gomphinella* is found in the Pliocene and Recent of Japan and New Zealand, and the genus *Gomphina* sensu lato in Australian Recent seas as well.

Protothaca is distributed along the western coasts of South and North America in Japan and New Zealand. The species from our seas has been separated as a subgenus, *Tuangia*, because of it's shape and coarse culpture, but we know nothing of its Tertiary history. The only fossil occurrence in New Zealand so far recognized is from a raised beach apparently of Pleistocene age. Concerning the genus von Ihering (1907, p. 296) said "*Protothaca* au contraire est un élément charactéristic de la faune eogène de la Patagonie, et du Chile, d'où elle s'est répandue jusqu'à la Californie pendant la formation Miocène."

Paphirus, Irona, and *Notopaphia* have relatives in *Ruditapes, Pullastra* and *Venerupis*. These genera are found in the regions to the north-west and west of New Zealand, *i.e.*, the Indo-Pacific, the Australian and the European. *Irona* and *Notopaphia* have not yet been found earlier than the Pleistocene but *Paphirus* is common in the Upper and Middle Pliocene.

From the foregoing it will be seen that the evidence does not support the idea that the Veneridae of New Zealand have been isolated since Cretaceous times and that the late Tertiary and Recent species have been derived directly and solely from the Cretaceous fauna of this region. Indeed the fact that the whole subfamily of the Venerinae is known only from the Tertiary and is so well represented in New Zealand seems to prove that important migrations reached these shores (or left them) after the close of the Cretaceous. The stratigraphical occurrence, as far as known, of the different genera, is shown in table 1.

Of course the great imperfection of the geological record is well known, but on the other hand it must be conceded that New Zealand possesses a remarkably complete Tertiary sequence. Taking these facts into account, the writer is of the opinion that the generic likeness between southern Australian and New Zealand Venerids may be due to parallel migrations from a northern area of dispersal about the middle of the Eocene. Possibly the appearance of *Phacosoma, Gomphinella, Paphirus, Irona, Notopaphia,* and *Tuangia* in the later Tertiary points to another invasion from the north in the early Pliocene, but the evidence for this is by no means strong.

(b) STRATIGRAPHICAL TABLES.

TABLE 1.—APPROXIMATE RANGE OF GENERA AND SUBGENERA.

Note.—The stages of this table are not claimed to be accurate or complete. They are intended only as a rough guide. The Mokau beds have been provisionally included in the Awamoan, and the Clifden beds in the Hutchinsonian. The Tongoporutuan and Onairoan stages used in former papers by the writer have been united under the name Taranakian (See Grange, 1926, p. 334).

—	Upper Cretaceous	TERTIARY											Pleistocene	Recent
		Eocene			Oligocene			Miocene		Pliocene				
		Wangaloan	Bortonian	Tahuian	Waiarekan	Ototaran	Hutchinsonian	Awamoan	Taranakian	Waitotaran	Nukumaruan	Castlecliffian		
(Austrodosinia) ...							—	—	—	—	—	—	—	—
(Phacosoma) ...										—	—	—	—	—
(Dosinia)							—	—	—	—	—	—	—	—
(Raina)						—	—	—	—	—	—			
(Kereia)		—	—	—	—	—	—	—	—	—	—	—	—	—
(Kakahuia)			—											
Finlaya		—												
(Notocallista) ...						—	—	—	—	—	—	—	—	—
(Hyphantosoma) ...							—							
(Tikia)	—													
Kuia						—	—	—						
Marama				—	—	—	—	—	—	—				
(Hina)			—	—	—	—	—	—						
Dosinula							—	—	—	—	—	—	—	—
Turia			—	—	—	—	—	—	?					
Tawera								—	—	—	—	—	—	—
Bassina						—	—	—	—	—	—	—	—	—
Clausinella... ...							?							
(Austrovenus) ...											—	—	—	—
(Hinemoana) ...						?								
Eumarcia						—	—	—	—	—	—			
(Atamarcia) ...					—	—	—	—	—	—	—			
Cyclorismina ...	—													
(Gomphinella) ...										—	—	—	—	—
(Tuangia)													—	—
(Callistotapes) ...							—							
Paphirus											—	—	—	—
Irona													—	—
Notopaphia ...													—	—

TABLE 2.—APPROXIMATE RANGE OF SPECIES.—*Continued.*

—		TERTIARY												
		Eocene			Oligocene			Miocene		Pliocene				
	Upper Cretaceous	Wangaloan	Bortonian	Tahuian	Waiarekan	Ototaran	Hutchinsonian	Awamoan	Taranakian	Waitotaran	Nukumaruan	Castlecliffian	Pleistocene	Recent
Dosinia lambata ...							?			—	—	—	—	—
" *anus* ...											—	—	—	—
" *magna* ...							?	—						
" *densicosta* ...								—						
" *waitakiensis*							—							
" *horrida* ...											—			
" *subrosea* ...													—	—
" *wanganuiensis*												—		
" *maoriana* ...												—	—	—
" *bensoni* ...								—						
" *paparoaensis*								—						
" *waipipiensis* ...										—				
" *nukumaruensis*											—			
" *greyi* ...										—	—	—	—	—
" *cottoni* ...								—						
" *waiparaensis*										?				
" *mackayi* ...			—											
" *ongleyi* ...		—												
" *perplexa* ...		—												
" *suteri* ...			—											
Finlaya parthiana ...		—												
Paradione multistriata									?	—	—	—	—	—
" *parki* ...						—	—	—						
" *trigonalis* ...							—							
Pitar sculpturatus ...							—							
Callistina thomsoni ...	—													
" *wilckensi* ...	—													
Kuia vellicata ...						—	—	—						
" *macdowelli* ...							—							
" *singularis* ...							—							
Marama pristina ...				—										
" *ovata* ...								—						
" *hurupiensis* ...								—						
" *murdochi* ...										—				
" *vaga* ...				—										
" *pinguis* ...							—							
" *tumida* ...							—							
" *williamsi* ...								—						
" *mackenziei* ...								—						
" *hendersoni* ...								—						
Dosinula zelandica ...										—	—	—	—	—
" *crebra* ...										●	—	—	—	—
" *elegans* ...								?						
" *suboblonga* ...								—						
" *uttleyi* ...							—							
" *firmocosta* ...							—							
Turia bortonensis ...			—											
" *chattonensis* ...						—								
" *pukeuriensis*								—						
" *waiauensis* ...							—							
Tawera marshalli ..								—						

TABLE 2.—APPROXIMATE RANGE OF SPECIES.—*Continued.*

—	Upper Cretaceous	TERTIARY											Pleistocene	Recent
		Eocene			Oligocene			Miocene		Pliocene				
		Wangaloan	Bortonian	Tahuian	Waiarekan	Ototaran	Hutchinsonian	Awamoan	Taranakian	Waitotaran	Nukumaruan	Castlecliffian		
Tawera bartrumi ...										—				
,, *errans* ...										—				
,, *subsulcata* ...										?	—			
,, *assimilis* ...											?			
,, *wanganuiensis*												—		
,, *spissa* ...									?	—	—	—	—	—
Bassina yatei ...								—	—	—	—	—	—	—
,, *speighti* ...						—	—	—						
,, *parva* ...											—			
Clausinella morgani ...							?							
Tawera carri ...									—					
Chione stutchburyi ...											—	—	—	—
,, *crassitesta* ...											—			
,, *acuminata* ...						?								
Notopaphia elegans ...													—	—
Protothaca crassicosta													—	—
Cyclorismina woodsi ...	—													
Eumarcia pareoraensis								—						
,, *kaawaensis* ...										—				
,, *plana* ...									—	—	- -			
,, *altilunula* ...							—							
,, *crassa* ...					—									
,, *crassatelliformis*							—							
,, *curta* ...							—							
,, *sulcifera* ...							—							
,, *enysi* ...							—							
,, *thomsoni* ...								—						
,, *benhami* ...										—	—			
Gomphina maorum ...										—	—	—	—	—
Paphia finlayi ...							—							
Paphirus largillierti ...												—	—	—
Irona reflexa ...													—	—

(c) LIST OF FOSSILIFEROUS LOCALITIES ARRANGED ACCORDING TO SUPPOSED AGE.

Pleistocene:

689 Raised Beach, Mahia Peninsula.

Castlecliffian:

Landguard Bluff; Castlecliff; Kai-iwi; Okehu; (all near Wanganui).

Nukumaruan:

1064, Nukumaru Beach; 1121, Wharekahika River, East Cape; 1096, Petane Clay, Esk Bridge; 1089, Okauawa Creek, Ngaruroro River; Kereru, Hawke's Bay; Castle Point; 184, Porangahau Creek, Ruataniwha Plain; 1040, Twaite's Cutting, Martinborough; Greta Beds, Kowai River, Waipara.

Waitotaran:

996 Kaawa Creek, Waikato coast; Neilson's Quarry, Whangamomoa Road, Tarata; Pohokura Tunnel; 875, Mouth of Waingongoro River; 876, 1173, Waihi Stream, Hawera Beach; 1101 Waipipi Beach (this and preceding five in Taranaki); lower limestone, Napier; 858, Starborough Creek, Marlborough; Motunau, North Canterbury; Motunau beds, Waipara River.

Taranakian:

Titirangi Stream, North Taranaki.

Mokau beds (perhaps equivalent to Awamoan):

908, Tongaporutu Road, three miles south-west of Ohura; 919, Awakino Valley Road; Paparoa Rapids, Wanganui River; 1022, Waterfall, Mangapapa Stream, Tangarakau River; 1065 Kururau Road, three miles west of Taumarunui; 1130, Mohakatino River; 1150, junction of Papakino and Tongaporutu rivers; Quarry, Dannevirke-Herbertville Road; Fox River, West Nelson; 94, Brewery Creek, Mokihinui; Kanieri; lower beds, Lower Gorge of Waipara River; 1037 Hurupi Creek, Palliser Bay.

Awamoan:

Mead Gorge, Marlborough; 237 Broken River; shell bed, Junction of Porter and Thomas Rivers, Trelissick Basin (probably same as 237); 165, White Rock River, Upper Pareora; 458, Lower Gorge, Pareora River; 475, Mt. Harris, South Canterbury; Pukeuri Cutting; shell bed, Target Gully; Ardgowan; Parson's Creek; Rifle Butts, Cape Wanbrow; Awamoa; blue sandstone, Campbell's Beach, All Day Bay (this and preceding six near Oamaru).

Hutchinsonian:

Pakaurangi Point, Kaipara; ? 243, Fan Coral bed, Trelissick; ? tuffs between upper and lower limestones, Trelissick; Otiake, Waitaki Valley; Trig Z, Otekaike, Waitaki Valley; Clifden; Mussel Beach; Orepuki (this and preceding two Southland).

Ototaran:

476, Wharekuri Greensand, Waitaki Valley; Chatton Creek, near Gore; Pomahaka.

Waiarekan:

Hikurangi, Coal Mine; 1029, 90 chains north-west of Trig. B, Alexandra Survey District; greensand at base of Tertiary, boundary of blocks 10 and 11 Awaroa Survey Districts, Huntly.

Tahuian:

Greensands, McCullough's Bridge, Waihao River.

Bortonian:

164, greensand, Kakahu; Waihoa Downs, South Canterbury; 176, Black Point, Waitaki River.

Wangaloan:
Boulder Hill, eight miles north-west of Dunedin; Measly Beach, Wangaloa; Castle Hill shaft, Wangaloa.

Upper Cretaceous:
587, Selwyn Rapids.

(d) NOTES ON FOREIGN SPECIES.

Much has been written on the specific resemblance of New Zealand Tertiary fossils to those from the Patagonian formation of South America; but the supposed relationships, as far as investigated, are not so close as claimed. Far from being specifically identical, the Venerids concerned do not agree even generically.

Chione meridionalis (Sowerby)

Hutton thought that his *Chione vellicata* was conspecific with *C. meridionalis* (Sowb.) and Suter upheld the identification. Von Ihering (1907, p. 309) advocated the specific separation of *vellicata* from *medidionalis* but thought the species were very similar. His New Zealand specimen was a closed individual from Greta Valley, so he did not see the hinge; and further, it is extremely doubtful that he was dealing with a true *C. vellicata.* Cossmann said that the two species were not closely related, but he did not show wherein the difference lay. According to von Ihering, *C. meridionalis* belongs to his section *Ameghinomya,* which has well developed radial ribs and is closely related to *Periglypta puerpera* (Linné), lacking only the furrow along the escutcheon. *C. vellicata,* however, has no radial ribs, and the hinge is quite unlike that of *Periglypta.* It has in this paper been made the type of a new genus, *Kuia.*

Chione chiloensis (Philippi)

The specimens from Castle Point identified as *C. chiloensis* by Suter are decorticated examples of *Dosinula crebra* (Hutton), a close relative of *D. zelandica* Gray. They are therefore not even generically related to *C. chiloensis,* which is a *Protothaca.*

The shell described by Suter (1917, p. 75) as *Chione chiloensis* var. *truncata* has no relation with the South American shell, for it is, as far as can be seen, a weathered *Bassina,* not specifically separable from *Bassina yatei* (Gray).

Chione subroborata Tate.

Chione subroborata Tate was shown by the writer (Marwick, 1924, A p. 322) to be quite distinct from the New Zealand fossil so identified by Suter. The latter was given the name *C. morgani,* but in the present paper it is shown to have a sculpture similar to that of *Clausinella thiara* Dillwyn, and is therefore classed with that species under *Clausinella.*

(e) Summary of New Classification.

Comparison of Suter's and Woods's classifications with that adopted in this paper. (The species that have been made type of a genus or subgenus are marked G.T.)

Suter's classification	Revised classification
Dosinia (Dosinia) lambata (Gould)	*Dosinia (Dosinia) lambata* (Gould)
Dosinia (Austrodosinia) anus Philippi	*Dosinia (Austrodosinia) anus* (Philippi) G.T.
Dosinia (Austrodosinia) magna Hutton	*Dosinia (Austrodosinia) magna* Hutton.
Dosinia (Austrodosinia) subrosea Gray	*Dosinia (Phacosoma) subrosea* (Gray)
Dosinia (Orbiculus) caerulea Reeve	*Dosinia (Phacosoma) maoriana* Oliver.
Dosinia (Dosinisca) greyi Zittel	*Dosinia (Kereia) greyi* Zittel G.T.
Macrocallista multistriata (Sowb.)	*Paradione (Notocallista) multistriata* (Sowb.)
Macrocallista sculpturata Marshall	*Pitar (Hyphantosoma) sculpturatus* (Marshall).
Callista thomsoni Woods	*Callista (Tikia) thomsoni* (Woods) G.T.
Callista wilckensi Woods	*Callista (Tikia) wilckensi* (Woods)
Chione meridionalis Sowb.	*Kuia vellicata* (Hutton) G.T.
Cytherea (Circomphalus) chariessa Suter	*Kuia vellicata* (Hutton) G.T.
Dosinia tumida Marshall	*Marama (Hina) tumida* (Marshall)
Cytherea (Circomphalus) oblonga (Hanley)	*Dosinula zelandica* (Gray) G.T.
Cytherea (Circomphalus) crebra (Hutton)	*Dosinula crebra* (Hutton)
Chione chiloensis (Phil.)	*Dosinula crebra* (Hutton)
Chione (?) *elegans* (Hutt.)	*Dosinula elegans* (Hutton)
Chione (Lirophora) yatei (Gray)	*Bassina yatei* (Gray)
Chione chiloensis truncata (Suter)	*Bassina yatei* (Gray)
Chione speighti Suter	*Bassina speighti* (Suter)
Chione subroborata Tate	*Clausinella morgani* (Marwick)
Cytherea (Circomphalus) subsulcata (Suter)	*Tawera subsulcata* (Suter)
Macrocallista assimilis (Hutt.)	*Tawera assimilis* (Hutton)
Chione (Chamelea) spissa (Desh.)	*Tawera spissa* (Desh.) G.T.
Chione (Chamelea) mesodesma (Q. & G.)	*Tawera spissa* (Desh.) G.T.
Chione (Timoclea) stutchburyi (Gray)	*Chione (Austrovenus) stutchburyi* (Gray) G.T.
Chione acuminata Hutton	*Chione (Hinemoana) acuminata* (Hutton) G.T.
Venerupis elegans (Desh.)	*Notopaphia elegans* (Desh.) G.T.
Paphia (Protothaca) costata (Q. & G.)	*Protothaca (Tuangia) crassicosta* (Desh.) G.T.
Dosinia sp. of Woods	*Cyclorismina woodsi* Marwick G.T.
Macrocallista pareoraensis Suter	*Eumarcia pareoraensis* (Suter)
Paphia (Ruditapes) curta (Hutton)	*Eumarcia (Atamarcia) curta* (Hutton)
Cytherea enysi Hutton	*Eumarcia (Atamarcia) enysi* (Hutton)
Cytherea (Corcomphalus) sulcata (Hutton)	*Eumarcia (Atamarcia) benhami* Marwick
Gomphina maorum Smith	*Gomphina (Gomphinella) maorum* Smith G.T.
Paphia (Ruditapes) intermedia (Q. & G.)	*Paphirus largillierti* (Philippi) G.T.
Paphia (Ruditapes) fabagella (Desh.)	*Paphirus largillierti* (Philippi) juv.
Venerupis reflexa Gray	*Irona reflexa* (Gray) G.T.
Venerupis siliqua Desh.	*Irona reflexa* (Gray) G.T.

List of new species and their type localities described in this paper. (Types of new genera or subgenera marked G.T.)

Dosinia (Austrodosinia) waitakiensis	Otiake
Dosinia (Austrodosinia) kaawaensis	Kaawa Creek
Dosinia (Austrodosinia) horrida	Nukumaru
Dosinia (Phacosoma) wanganuiensis	Castlecliff
Dosinia (Raina) bensoni	Target Gully G.T.
Dosinia (Raina) paparoaensis	Paparoa Rapids
Dosinia (Raina) waipipiensis	Waipipi Beach
Dosinia (Raina) nukumaruensis	Nukumaru Beach
Dosinia (Kereia) ongleyi	Wangaloa
Dosinia (Kereia) perplexa	Wangaloa
Dosinia (Kereia) mackayi	Black Point
Dosinia (Kereia) cottoni	Hurupi Creek
Dosinia (Kereia) waiparaensis	Mt. Brown
Dosinia (Kereia) densicosta	Target Gully
Dosinia (Kakahuia) suteri	Kakahu
Paradione (Notocallista) parki	Parson's Creek, Oamaru
Paradione (Notocallista) trigonalis	Clifden, Southland
Finlaya parthiana	Boulder Hill G.T.
Kuia macdowelli	Clifden, Southland
Kuia singularis	Clifden, Southland
Marama pristina	McCullough's Bridge
Marama ovata	Pukeuri
Marama hurupiensis	Hurupi Creek
Marama murdochi	Hawera Beach G.T.
Marama (Hina) vaga	McCullough's Bridge
Marama (Hina) pinguis	Pakaurangi Point G.T.
Marama (Hina) williamsi	Allday Bay
Marama (Hina) mackenziei	Awamoa Creek
Marama (Hina) hendersoni	Tongaporutu River
Dosinula suboblonga	Target Gully
Dosinula uttleyi	Otiake
Dosinula firmocosta	6B. Clifden, Southland
Turia bortonensis	Black Point
Turia chattonensis	Chatton Creek G.T.
Turia pukeuriensis	Pukeuri
Turia waiauensis	8a Clifden, Southland
Tawera marshalli	Target Gully
Tawera bartrumi	Kaawa Creek
Tawera errans	Waipipi Beach
Tawera wanganuiensis	Castlecliff
Tawera carri	Mahoe S.D. Taranaki
Bassina parva	Ngaruroro River
Cyclorismina woodsi	Selwyn Rapids G.T.
Eumarcia kaawaensis	Kaawa Creek
Eumarcia plana	Nukumaru
Eumarcia altilunula	7c Clifden, Southland
Eumarcia (Atamarcia) crassa	Alexandra S.D., Kawhia
Eumarcia (Atamarcia) crassatelliformis	Mussel Beach, Southland
Eumarcia (Atamarcia) trigonalis	7c Clifden, Southland
Eumarcia (Atamarcia) sulcifera	Target Gully G.T.
Eumarcia (Atamarcia) thomsoni	Hurupi Creek
Paphia (Callistotapes) finlayi	Clifden, Southland.

PART 3. SYSTEMATIC.

(1) SUBFAMILY DOSINIINAE.

The origin of the shells grouped under *Dosinia sensu lato* is uncertain. Jukes-Browne (1914, p. 59) wrote " *Pitaria* appears in the Eocene and is probably the ancestor of *Dosinia* which does not

make its appearance till the Oligocene and then only in America, the earliest European *Dosinia* being of Miocene date." This apparent difference in age between American and European occurrences was due to differences of opinion as to the boundaries of the Oligocene and Miocene (Vaughan 1924, p. 727). In both countries *Dosinia* appears in the Aquitanian (Cossmann and Peyrot 1911, p. 405).

Von Ihering, however, claimed a much earlier appearance of the genus in the Southern Hemisphere (1907, p. 298), "Le genre n'est pas representé dans la craie des Indes, mais il a été trouvé dans la formation crétacée du Chili et de l'Argentine (Roca).... Il faut donc conclure que le genre *Dosinia* est un élément ancien des côtes antarctique de l'Archinotis." As Stoliczka has pointed out that the Cretaceous records of *Dosinia* "are mostly not true Dosinias but belong to *Cyprimeria* and other groups" (Dall 1903, p. 1224) it would be interesting to know if the hinges of these South American shells have been clearly exposed. White (1888, p. 97, pl. 8, figs. 13, 14, 15) described and figured *Dosinia brasiliensis* from several localities in the Upper Cretaceous of Sergipe, Brazil. None of his figures shows the hinge, but the text describes the sublunular tooth as strong. If this is correct, the shell is certainly not a *Cyprimeria*.

Other Cretaceous records of Dosinia from Tunis and Portugal were given by Woods (1917, p. 32) in describing two unnamed "*Dosinia* sp." from the Upper Senonian of Selwyn Rapids, New Zealand; but unfortunately these northern occurrences were not mentioned by Dall, Jukes-Browne or Cossmann and Peyrot, so the writer was unable to ascertain if the hinges had been examined. The teeth of three of the New Zealand specimens handled by Woods have now been partly cleared of their resistant matrix and the absence of an anterior lateral tooth is certain. They are described below as *Cyclorismina woodsi* n. gen., n. sp.

Dosinia, however, occurs long before the Aquitanian in New Zealand. It is true that no exact correlation of our strata with European stages is yet possible, but from the relative position of the beds in the Tertiary of New Zealand one can make a fair guess at their approximate age. *Dosinia mackayi* from the Bortonian of North Otago is certainly pre-Aquitanian, perhaps Upper Eocene, and *Dosinia ongleyi* from Wangaloa is still older, occurring in beds that have often been classed as Cretaceous but which are probably Paleocene.

After this paper was in the press, the writer noticed that the anterior tubercle in the left valve of *Dosinia* had arisen from an extension of the anterior cardinal. This may be seen clearly in the new subgenus *Kereia*, also in young stages of *Dosinia lambata* (Gould) and probably in young stages of many other species. It follows that the Dosiniinae are not closely related to the Meretricinae as generally supposed; but have been derived from such shells as the Cretaceous *Cyprimeria* and *Cyclorisma*. For further remarks on the significance of this tubercle see p. 598.

Although *Dosinia* is a common genus in the middle and later Tertiary of New Zealand, complete shells are difficult to collect, so that identifications have generally to be made either from specimens showing only the exterior or from fragments showing the hinge. The

only extinct species hitherto described is *D. magna*, a name that has been applied to all the large specimens irrespective of important differences in hinge, shape and sculpture. A surface somewhat resembling that of *Dosinia greyi*, i.e. narrow, well spaced lamellae with rough edges, is often produced by weathering of shells normally possessing an almost flat surface with concentric grooves; consequently the records of *D. greyi* are widespread and quite unreliable.

A study of the Tertiary fossils of this genus shows that a great number of them cannot be placed with the already described species, but must be given new specific names. Owing to the difficulty that would arise in making other identifications, many of the fragmentary specimens though certainly belonging to new species must for the present be left without specific diagnosis, so that the list of species described below is by no means exhaustive.

1. Genus DOSINIA Scopoli 1777.

Type: *D. africana* Hanley.

KEY TO SUBGENERA REPRESENTED IN NEW ZEALAND.

(1) Outline circular.
- A. Sculpture of concentric ridges.
  - 1. Right posterior cardinal much broader than median .... *Raina.*
  - 2. Right posterior cardinal narrow.
    - (*a.*) Right median cardinal long, sides subparallel, anterior lateral very strong, rugose; escutcheon with strong crest, pallial sinus horizontal .... *Austrodosinia*
    - (*b.*) Right median cardinal triangular, strongly bevelled, pallial sinus fairly long, ascending.
      - (1) Lunule deeply sunk, sculpture fine, escutcheon without raised edges in left valve .... *Phacosoma*
      - (1) Lunule deeply sunk, sculpture fine, escutcheon with raised edges in left valve .... *Dosinia* s. str
- B. Sculpture of spaced sharp lamellae .... *Kereia.*

(2) Outline roundly trigonal .... *Kakahuia.*

a. Subgenus **Dosinia** s. str.

The New Zealand Recent shell *D. lambata* (Gould) agrees in general features fairly closely with *D. africana* Hanley, but has much finer sculpture, a shallower lunule, and consequently more divergent hinge-teeth. The posterior cardinals and nymphs are the same in both shells; but the right median cardinal of *lambata* is directed further forward. The right anterior cardinal is also directed further forward and the space between these two is almost in a line with the anterior lateral pit. In *africana* this space is not in line with the lateral pit, which is, moreover, deeper than in the New Zealand shell. *D. lupina* (L.) from the Recent Seas of Europe is of the same shape as *lambata*, but the strength of the sculpture is intermediate between *africana* and *lambata*. The divergence of the hinge is also intermediate but the anterior lateral is strong. It seems fairly certain that *D. lambata* is closely related to both *D. africana* and *D. lupina*.

b. Subgenus **Austrodosinia** Dall, 1902.

Type: *Cytherea anus* Philippi.

Austrodosinia has coarse concentric ridges which rise into a crest bounding the escutcheon and are also well raised near the lunule. The hinge has rugose, somewhat narrow but long median cardinals in both valves. These are slightly bevelled and grooved along their whole length. The left anterior lateral is extremely large and very rough, as is also the pit for its reception. The pallial sinus is horizontal, and rather short.

Jukes-Browne thought that in *D. anus* " the middle cardinal teeth are not bifid in adult shells being merely rugose, in young shells the left middle cardinal is grooved near the top, but that of the right is not bifid." Fig. 12 below gives a dorsal view of a large Recent specimen 73 mm. long, and clearly shows that he was mistaken.

In *Dosinia* s. str., *Phacosoma,* etc., the median cardinals are more triangular, more strongly bevelled and the grooves divide the teeth more unequally.

KEY TO SPECIES.

(1) Sculpture of low, bevelled ridges	*anus*
(2) Sculpture of high, bevelled ridges	
A. Ridges fine	*kaawaensis*
B. Ridges coarse	
1. Lunule deep	*horrida*
2. Lunule shallow	*waitakiensis*
(3) Sculpture uncertain, lunule arched, anterior lateral conical, left median cardinal very stout	*magna*

c. Subgenus **Phacosoma** Jukes-Browne, 1912.

Type: *Artemis japonica* Reeve.

Jukes-Browne severely criticised Dall's *Dosinorbis,* type *D. bilunata* (Gray), saying that the feature on which the genus was founded, *i.e.,* the appearance of a double lunule, was a specific not a generic character. He therefore chose what he considered a more typical species *D. japonica* as type of a new genus *Phacosoma* to which he referred Dall's *Dosinorbis.* This mistake in method was pointed out by Iredale (1915, p. 494) who, considering the matter mainly from the standpoint of the literature, revived *Dosinorbis* and placed therein *D. subrosea* and *D. caerulea,* though it is not clear whether he meant the true *D. caerulea* or Suter's wrong interpretation of it (now *D. maoriana* Oliver).

The writer favours Dall's isolation of *D. bilunata* under *Dosinorbis* as a monotypical subgenus and the recognition of *Phacosoma,* because the peculiar anterior area in *D. bilunata,* like a second larger lunule, has probably quite a long history behind it, and the disposition of the anterior cardinals and laterals is different from that of *Phacosoma.* No specimen of *D. japonica* was available for the present revision, so the writer has had to base his conception of *Phacosoma* on a fossil specimen of *D. troscheli* Lischke, and on figures and descriptions of the type. If this species is correctly associated with *D. japonica* there is little difference between *Phacosoma* and *Dosinia* s. str. except in the escutcheon which is deeper in *Phacosoma;* the shape of the shell and the arrangement of the hinge-teeth are practically the same.

KEY TO SPECIES.

(1) Shell generally winged posteriorly, escutcheon well defined though narrow.
A. 20-25 concentric ridges per centimetre .... *subrosea*
B. 12-15 concentric ridges per centimetre .... *wanganuiensis*
(2) Shell circular, escutcheon not defined .... *maoriana*

d. Subgenus **Raina** n. subgen. (from Ra the Maori Sun God).

Type: *Dosinia bensoni* Marwick.

Shell large. Lunule long, only slightly impressed, well defined; escutcheon broad and deep in left valve, smaller in right. Sculpture of light concentric grooves separating flat polished interspaces which are raised into low narrow ridges near lunule and on posterior area. Left hinge with high curved posterior cardinal; rather narrow, straight median cardinal unequally divided; and long straight anterior cardinal; anterior lateral strong, elongate, rugose on lower side. Right hinge with long, broad, deeply and widely grooved, posterior cardinal with shoulder at top; a somewhat narrow, rugose grooved median cardinal; and a very weak anterior one; lateral pit large but shallow, rugose on lower side, almost smooth above. Pallial sinus short, angular, ascending.

Raina is characterized by its large, shallow lunule, very large shouldered right posterior cardinal, and short, angular, ascending sinus. The Mid-Tertiary type species has a polished surface with light concentric grooves separating flat interspaces, but on Pliocene descendants the sculpture is stronger so that the interspaces become raised ridges and the surface is like that of *Austrodosinia*.

KEY TO SPECIES.

(1) Sculpture of concentric lines with flat interspaces on centre of disc .... *bensoni*
(2) Sculpture of close raised bevelled ridges .... *nukumaruensis*
(3) Sculpture of somewhat spaced bevelled ridges with rounded interspaces .... *waipipiensis*
(4) Sculpture uncertain, diameter 2 ins. or less, dorsal margin strongly arched, anterior end long, pallial sinus long, ascending .... *paparoaensis*

e. Subgenus **Kereia,** n. subgen. (from Kawana Kerei—the Maori name for Governor Sir George Grey.

Type: *Dosinia greyi* Zittel.

Shell inflated. Lunule shallow, bounded by deeply incised line; escutcheon absent. Sculpture of distant, raised, sharp, concentric lamellae. Teeth strongly divergent; right hinge with a short lamellar anterior cardinal; triangular grooved median, and very broad, grooved, posterior cardinal; anterior pit long, rugose on lower side with well defined lateral above, weaker one below. Left hinge with long triangular anterior cardinal; broad, grooved, median; and high lamellar posterior cardinal; anterior lateral long, only moderately high, rugose.

This subgenus is easily distinguished by its high, spaced lamellae and divergent teeth. In the early Tertiary species *D. mackayi* and *D. ongleyi* the concentric lamellae have not yet developed.

KEY TO SPECIES.

(1) Adult shell about 1⅛ inches high, concentric lamellae spaced.	
A. Shell not greatly inflated	*densicosta*
B. Shell well inflated	
1. Sculpture coarse	
(*a*) Outline circular, no escutcheon	*greyi*
(*b*) Posterior winged, well defined escutcheon	*cottoni*
2. Sculpture very fine	*waiparaensis*
(2) Adult shell about one inch high, sculpture of short, close concentric ridges.	
A. Anterior lateral well separated from cardinal	*mackayi*
B. Anterior lateral almost joined to cardinal	*ongleyi*

f. Subgenus **Kakahuia** n. subgen.

Type: *Dosinia suteri*, Marwick.

Shell rather small, roundly trigonal, beaks high. Lunule shallow, bounded by an incised line; escutcheon narrow in right valve, probably wider in left. Sculpture of fine spaced concentric lamellae, two to three per mm. Hinge of right valve with broad curved grooved posterior cardinal; rather narrow entire median cardinal, paired with moderately strong entire anterior one, both sloping forward; anterior pit deep, rugose below and with weak lateral above. Nymph deep, striated on ligamental and resiliary surfaces.

Dosinia (Dosinia) lambata (Gould) 1850 (Figs. 8, 9, 11).

For synonymy see Suter's *Manual*, p. 976.

Localities.—Recent (type);

Castlecliff, Wanganui;

Maraekakaho, Ngaruroro River;

876, Mouth of Waihi Stream, Hawera;

858, Starborough Creek, Marlborough;

Trig. Z., Otekaike, Waitaki Valley.

Easily distinguished by its prominent beaks, shallow escutcheon, and extremely fine sculpture.

Dosinia (Austrodosinia) anus (Philippi) 1848 (Figs. 7, 10, 12, 13).

For synonymy see Suter's *Manual*, p. 978.

Localities.—Recent (type);

Shrimpton's, Ngaruroro River (H. J. Finlay coll.);

Nukumaru.

Dosinia (Austrodosinia) magna Hutton (Figs. 18, 19).

1873. *Dosinia magna* Hutton, Cat. Tert. Moll., p. 22.

1914. *Dosinia magna* Hutton: Suter, *N.Z. Geol. Surv. Pal. Bull. No. 2,* p. 50, pl. 14, fig. 7.

Practically every large *Dosinia* from the Oamaruian has been identified as *D. magna,* but an inspection of the hinge and other characters shows that there are several undescribed species, particularly from Awamoan horizons. Figure 18 shows the hinge of the holotype, a left valve, while the right valve, fig. 19, was collected by Dr. J. A. Thomson from the shell bed at the base of the Pareora Beds, junction of Porter and Thomas Rivers, Trelissick Basin, and

so may be a topotype. The left valve has an enormous, bluntly-conical, anterior lateral tooth, a lamellar anterior cardinal, a very broad, unequally-divided, median cardinal, and an arched posterior cardinal which, with the raised lunular margin, forms a semicircle. In the right valve the posterior cardinal is only of moderate width, the median cardinal has a semilunar shape, and appears to be entire. The anterior pit is deeply excavated and has low rugose laterals. The lunule is fairly broad and rather well impressed, but the margin is arched and pouts strongly. The pallial sinus though obscured, appears to be of only moderate depth and to point about the bottom of the anterior adductor. The true sculpture was in no case seen; but the specimen collected by Dr. Thomson seems to have had close, raised, concentric ridges.

Localities: Trelissick Basin (type); Ardgowan, Oamaru (H. J. Finlay) fragment; 8B Clifden, Southland (H. J. Finlay).

Dosinia (Austrodosinia) kaawaensis n. sp. (Figs. 14, 15).

Shell of moderate size, suborbicular, thin, flat; beaks fairly prominent. Lunule very small, deeply impressed, narrowly lanceolate; escutcheon narrow in right valve, stronger in the left. Sculpture of fine, erect, sharp, spaced, concentric ridges which narrow towards the extremities and form a crest to the escutcheon. Hinge plate narrow and somewhat weak; right valve with an almost vertical, lamellar anterior cardinal; median and posterior cardinals of about equal strength and bifid; anterior pit with low corrugated laterals. Left valve with thin posterior cardinal; median strong, unequally divided; anterior vertical, lightly arched; anterior lateral elongated, rugose. Pallial sinus linguiform, horizontal.

Holotype in the collection of N.Z. Geol. Survey.

Height 40 mm., length 43 mm., thickness (1 valve) 8 mm.

Localities: 996, Kaawa Creek (= *D. anus* of Bartrum, 1919, p. 104); 1171, Patea.

Remarks: This shell is closely related to *D. anus* the chief difference being in the erect posture of the concentric ridges which in *D. anus* are broadly bevelled and relatively low.

Dosinia (Austrodosinia) waitakiensis n. sp. (Figs. 20, 22).

Shell large, solid, lunule moderately impressed, escutcheon deep; sculpture of strong, raised, concentric ridges with polished bevelled edges, becoming more erect and narrower distally, teeth like those of *D. magna* except that the anterior lateral is long, somewhat narrow and extremely rugose.

Type in the collection of Mr. H. J. Finlay.

Estimated diameter 60 mm.

Locality: Otiake, Waitaki Valley.

Dosinia (Austrodosinia) horrida n. sp. (Figs. 35, 38, 41).

Shell fairly large, circular, compressed. Lunule lanceolate, small, deeply impressed; escutcheon narrow in right valve, traversed by concentric ribs, in left valve fairly broad, well defined, smooth. Sculpture of strong, high, well-spaced ridges which become narrower and higher distally forming a crest to the escutcheon. Right hinge with small anterior cardinal; moderate, grooved median; and stronger,

curved, grooved posterior cardinal; nymph margin raised into lamella; anterior lateral pit deep, upper lateral well defined, lower side of pit strongly rugose. Left valve with curved lamellar posterior cardinal, moderate, unequally-grooved median; and curved, grooved anterior cardinal also of moderate strength but slightly longer; anterior lateral long, strong, deeply rugose. Pallial sinus broad, linguiform, horizontal, reaching about half-way across shell.

Holotype in collection of N.Z. Geological Survey.

Height 51 mm., length 47 mm., thickness (one valve) 12 mm.

Localities: 1164, Nukumaru Beach (type); 1102, Maraekakaho Creek.

The sculpture resembles that of *D. waitakiensis*, but is finer, the lunule is smaller and deeper and the anterior tooth of the left valve is curved backwards and so remains close to the median.

Dosinia (*Phacosoma*) *subrosea* (Gray) 1835. (Figs. 25, 26, 28).

For synonymy see Suter's Manual, p. 979.

Localities: Recent (type); Nukumaru?

Only incomplete examples of the Nukumaru shell have been seen, but apparently it has a shallower escutcheon, and the cardinals are somewhat more divergent than in the Recent shell. Further material is required before any reliable distinction can be made. A still older ancestor of *D. subrosea* occurs in the Waipipi beds, the hinge, however, is as yet unknown.

Dosinia (Phacosoma) wanganuiensis n. sp. (Figs. 24, 29, 30).

Shell large, strong. Lunule deeply impressed; escutcheon narrow, especially in right valve. Sculpture of bevelled, close, concentric ridges, 12 to 15 per centimetre. Hinge of left valve with long, thin, posterior cardinal; long, moderately thick, bevelled median cardinal with groove marking off low short anterior flange; and lamellar anterior cardinal; anterior lateral fairly strong, broad, somewhat rugose. Right valve with long, narrow, grooved posterior cardinal; broadly-triangular bevelled median cardinal with slight shoulder on posterior side; and short entire anterior cardinal; anterior lateral pit deep, broad, rugose with raised margins. Pallial sinus fairly deep tapering to narrow end, directed at middle of anterior adductor.

Holotype in collection of N.Z. Geological Survey.

Height 60 mm., length 63 mm., thickness (one valve) 15 mm.

Locality: Castlecliff, Wanganui.

Easily distinguished from *D. subrosea* by larger size and much coarser sculpture, the ridges being 12 to 15 per cm. instead of 20–25.

Dosinia (Phacosoma) maoriana Oliver (Figs. 4, 5, 6).

1906 *Dosinia caerulea* Reeve: Suter, *Trans. N.Z. Inst.*, vol. 38, p. 318 (not of Reeve).

1913 *Dosinia caerulea* Reeve: Suter, *Manual N.Z. Moll.*, p. 977, pl. 60, fig. 8.

1923 *Dosinia maoriana* Oliver, *Proc. Malac. Soc.*, vol. 15, p. 188.

This species is distinguished by its constant orbicular shape, insignificant escutcheon, and long rather narrow pallial sinus, rounded at the apex and pointing about the middle or upper part of the

anterior adductor. The anterior lateral tooth is tubercular and not so strong as that of *D. subrosea.*

Localities: Recent (type): Castlecliff, Wanganui.

Dimensions: Generally about 30 mm. high, but fossil specimens are as much as 52 mm.

Dosinia (Raina) bensoni n. sp. (Figs. 34, 36, 54).

Shell large, solid, suborbicular. Dorsal margin arched. Lunule long, lanceolate, moderately impressed; escutcheon fairly deep, well marked in left valve, much less so in right. Sculpture on central half of disc of narrow concentric grooves separating broad flat polished interspaces up to 2 mm. in width; on anterior and posterior these interspaces are raised into narrow ridges. Hinge-plate broad, arched; left valve with posterior cardinal strong and curved; median of moderate strength, unequally divided; anterior cardinal fairly strong, lateral tooth elongate, rugose, strong. Right valve with anterior cardinal short, high and thin; median strong, rugose, unequally divided; posterior strong, gently arched, deeply grooved, bearing a small projecting plate on left side of upper end; edge of nymph raised into sharp lamella; anterior lateral pit well defined, rugose on lower side. Pallial sinus relatively short, acute, pointing at top of anterior adductor.

Holotype deposited in collection of N.Z. Geological Survey by Dr. P. Marshall.

Height 70 mm., length 72 mm., thickness (one valve) 19 mm.

Localities: Target Gully (type): Ardgowan; Awamoa; 1130, Mokau beds, Mohakatino River; 1150, Mokau beds, junction Papakino and Tongaporutu Rivers; 1209, Quarry on Dannevirke-Herbertville Road, two miles N.W. of Waipatiki oil bore.

The true sculpture is often removed by weathering and the surface is then marked by spaced concentric ridges with smooth or striated interspaces. These shells can be distinguished from *D. magna* with which they have been previously confused, by the narrower left median cardinal, smaller, compressed anterior lateral, rugose divided right median cardinal and narrow superficial lunule.

Dosinia (Raina) paparoaensis n. sp. (Figs. 63, 64, 65).

Shell large, circular, moderately inflated; beaks low, at anterior fourth; dorsal margin arched, high. Lunule shallow, narrowly lanceolate; escutcheon insignificant. Sculpture probably of close strong concentric ridges, but owing to weathering this feature is not clear, weathered surface generally marked by strong concentric ridges sometimes regularly spaced. Left valve with thick grooved median cardinal, and narrow posterior and anterior ones; anterior lateral rather large, low, elongate, conical, rugose. Right valve with thick grooved posterior cardinal; moderate, grooved median; and small but strong anterior one; lateral pit well marked, rugose. Pallial sinus deep, pointing to the top of the anterior adductor.

Type in the collection of the N.Z. Geological Survey.

Height 53 mm., length 55m., thickness (one valve) 13 mm.

Locality: Paparoa Rapids, Wanganui River.

Remarks: This species resembles *D. bensoni* in its shallow lunule and rough surface when weathered. It can be distinguished, however,

by its small escutcheon, more closely placed left anterior and median cardinals, stronger right anterior cardinal, deeper sinus, high, arched dorsal margin and smaller size. This is the *D. subrosea* and probably *D. anus* of Marshall and Murdoch (1921, p. 85).

Dosinia (Raina) waipipiensis n. sp. (Figs. 49, 51).

Shell very large not much inflated. Lunule lanceolate, large, not very deeply impressed except towards anterior end, pouting strongly; escutcheon probably well-developed, but the single fragmentary right valve shows only the beginning of it. Sculpture of strong, sharp, raised, bevelled, spaced concentric ridges becoming lamellar and inclined distally. Hinge of right valve with high lamellar anterior cardinal; strong, slightly curved, weakly-grooved rugose median; and broad, deeply-grooved, curved posterior cardinal bearing on top anterior side a strong projecting shoulder; edge of nymph raised into strong lamella; anterior pit long with long well-defined lateral tooth above forming a continuation of the anterior cardinal, lower side of pit deeply rugose, the rugosities somewhat obscuring the lateral tooth. Pallial sinus reaching about half-way across shell, with narrow point directed at middle of anterior adductor.

Holotype in collection of N.Z. Geological Survey (deposited by Dr. P. Marshall).

Height (estimated) 75 mm., length (estimated) 80 mm., inflation (one valve) 18 mm.

Locality: Waipipi Beach, Waverley.

The strong spaced ridges with concave interspaces easily distinguish this shell from *D. bensoni* and *D. nukumaruensis*.

Dosinia (Raina) nukumaruensis n. sp. (Figs, 43, 45, 46).

Shell large, inflated, orbicular. Lunule large, lanceolate, not very deeply impressed, but well defined; escutcheon absent from right valve, well marked but narrow on left. Sculpture of fine, close, bevelled, low, concentric ridges. Hinge of right valve with short narrow anterior cardinal; strong rugose grooved median; and strong curved bifid posterior one bearing a projecting shoulder on anterior upper end; lower edge of nymph with raised lamella almost parallel to posterior cardinal; anterior lateral pit well marked, rugose on lower side. Left valve with fairly strong arched posterior cardinal; moderate, unequally-divided median; and slightly thinner, straight, grooved anterior cardinal; anterior lateral strong, elongate, somewhat rugose. Pallial sinus acute, pointing about middle of anterior adductor, reaching not quite half-way across shell.

Type in collection of N.Z. Geological Survey.

Height 68 mm., length 64 mm., thickness (one valve) 20 mm.

Localities: 1164, blueish sands, Nukumaru Beach; 1173, mouth of Waihi Stream, Hawera.

Easily distinguished from *D. bensoni* by the raised, bevelled ridges and the slightly deeper escutcheon. The hinges of these two species are practically the same.

Dosinia (Kereia) ongleyi n. sp. (Figs. 37, 39, 58, 59).

Shell small, circular, not inflated. Lunule large, lanceolate, somewhat impressed, pouting, bounded by well-incised line; escutcheon

narrow, bounded by well-defined ridge in left valve but not in right. Sculpture of concentric ridges with somewhat concave interspaces about two per mm. Right hinge with somewhat narrow, grooved posterior cardinal; short triangular, grooved median cardinal front edge sloping forward; fairly long, entire, anterior one also directed well forward; anterior pit part of a groove extending from between two front cardinals. Left hinge with long, narrow, slightly-curved posterior cardinal well separated from nymph by wide groove; moderately strong, bevelled, grooved median cardinal; very long narrow anterior cardinal curving forward below and running along hinge-margin; anterior lateral long and narrow, almost in a line with anterior cardinal. Nymphs hollowed out below the ligamental surface which is very short. Pallial sinus deep, ascending, directed at lunule. Valve margins smooth.

Holotype in collection of N.Z. Geological Survey.

Height 14·5 mm.; length 16 mm.; thickness (one valve) 3 mm.

Locality: Wangaloa (= *Dosinia greyi* Zittel of Suter 1921, p. 96).

The surface of the type is raised into ridges only on the early part, the later having concentric grooves separating flat interspaces of different widths on the centre of the disc. There are, however, sharp ridges on the posterior area.

Dosinia (? Kereia) perplexa n. sp. (Figs. 40, 53).

This species is based on a single right valve identified by Suter (1921, p. 96) as *D. lambata.* The sculpture consists of concentric ridges like most specimens of *D. ongleyi,* and the lunule also is the same. The umbones, however, are further forward and more prominent so that the outline is indeed like that of *D. lambata.* The right hinge has a broad, grooved posterior cardinal; and a narrowly-triangular, bevelled, grooved median one; but the anterior cardinal appears to be scarcely developed, forming with the upper anterior lateral a low ridge bounding a groove proceeding from between the two front cardinals and forming the anterior lateral pit. The lateral on the lower side of the pit is not joined to the median cardinal.

Holotype in collection of N.Z. Geological Survey.

Height 18 mm.; length 21 mm.; thickness (one valve) 4·5 mm.

Locality: Wangaloa.

If the hinge as described is normal, this shell should be made the type of a new genus. There is no sign of fracture to show that the anterior cardinal has been broken off, the low ridge being smoothly rounded on top. The lunular margin, however, is thick and invading the hinge-area. It is just possible that it is an abnormal development which caused the atrophy of the anterior cardinal, but this does not seem likely. However, until more light can be shed on the subject, the species is included under *Kereia.*

Dosinia (Kereia) mackayi n. sp. (Figs. 21, 31, 32, 33).

Shell small, thick, moderately inflated; beaks strong; outline almost circular, dorsal margin arched. Lunule not deeply impressed, of moderate size, limited by an incised line; escutcheon long, narrow. Sculpture of rather fine, close, concentric lamellae. Hinge-plate strong, arcuate, right valve with the anterior cardinal lamellar; median

cardinal triangular, grooved, separated by a wide space from the posterior which is strong, curved, and bifid. Left valve with three strongly-divergent cardinals, median strongest, bevelled and grooved; posterior separated by a groove from nymph; anterior lateral long and narrow, fairly prominent. Posterior muscular impression much larger than anterior; pallial sinus deep and wide, ascending, angled and pointing to about the top of anterior muscular impression.

Holotype in the collection of the N.Z. Geological Survey.

Height 25 mm., length 27 mm., thickness (one valve) 7 mm.

Localities: 176, Black Point (holotype); 164, coal greensands, Kakahu.

Remarks: This is the shell listed by Suter (1921, p. 72) as Dosinia magna from which it can be distinguished by its small size, wide spreading teeth, broad, high, pouting lunule and finer ornamentation.

Superficially this species most resembles D. maoriana, being of about the same size and shape, it may be distinguished by the larger and much less impressed lunule, and the divergent teeth.

Dosinia (Kereia) densicosta n .sp. (Figs. 16, 17).

Shell of moderate size, orbicular, flat; beaks inconspicuous. Lunule small, lanceolate, superficial, pouting; escutcheon absent. Sculpture of erect, high, closely-placed, concentric ridges about 1 mm. wide, with striated interspaces of equal width. Hinge-plate of moderate strength; left valve with the anterior and posterior cardinals laminar; median very strong and bifid; anterior lateral moderate, somewhat rugose; nymph narrow. Pallial sinus long and narrow, pointing at the top of the anterior adductor.

Type in collection of Mr. H. J. Finlay.

Height 40 mm. (circ.), length 40 mm. (circ), thickness (one valve) 9 mm.

Locality: Target Gully.

Distinguished from decorticated specimens of *D. bensoni* by its broader lunule and regular closely-placed concentric ridges, the left median cardinal is very stout as in *D. magna,* but the lunule is less arched and narrower than in that species, also the sculpture is different.

Dosinia (Kereia) cottoni n. sp. (Figs. 42, 47).

Shell large, solid, slightly-winged posteriorly; beaks strong, prominent, about anterior fourth, dorsal margin long, arched, fairly high. Lunule large, sagittate, shallow, pouting slightly in young specimens; escutcheon long and broad, keeled. Sculpture consisting of low, regular, erect, concentric lamellae inclined to become horizontal and overlap on posterior. Hinge-plate obscured, but as far as can be seen, left lateral is strong, weakly rugose on lower side, and well separated from anterior cardinal, left posterior cardinal is curved, fairly strong and has outer side longitudinally grooved. Pallial sinus narrow, deep, pointing to top of anterior muscular impression.

Holotype in the collection of the N.Z. Geological Survey.

Height 42 mm., length 46 mm., thickness (one valve) 11 mm.

Localities: 1037, mouth of Hurupi Creek, N.E. corner, Palliser Bay; ? Fox River, West Nelson, a distorted specimen, hitherto

classed as *D. greyi;* the presence of an escutcheon brings the shell nearer *D. cottoni.* ? 44, Brewery Creek, Mokihinui River. Poor specimen.

This species is nearest to *D. greyi* from which it differs in outline, the posterior wing being much more in evidence. *D. cottoni* is flatter, especially at the extremities, and has a prominent escutcheon.

Dosinia (Kereia) waiparaensis n. sp. (Fig. 48).

Shell large, solid, inflated, winged posteriorly; beaks strong, about anterior fifth. Lunule shallow, large, broadly sagittate; escutcheon narrow, fairly deep. Sculpture of fine regular spaced concentric lamellae about ·75 mm. apart. Hinge concealed in the single specimen.

Holotype in the collection of N.Z. Geological Survey.

Height 39 mm., length 45 mm., thickness (one valve) 15 mm.

Locality: Motunau beds, Waipara River, first exposure right side, opposite end of Mt. Brown cuesta. (= *D. greyi* of Suter, 1921, p. 46.

This shell is easily separated from others of the group by the very much finer sculpture, and broader lunule.

Dosinia (Kereia) greyi Zittel 1864 (Figs. 44, 50, 52).

For synonymy see Suter's *Manual,* p. 980.

Localities—Recent (uncommon): Castlecliff, Wanganui; Kai-iwi; 1040, Twaite's cutting, five miles south of Martinborough, Wairarapa; Waipipi Beach, north of Wairoa Stream, Waverley; Starborough Creek, Awatere Valley (J. A. Thomson). Awatere Valley (type) perhaps a lower horizon than Starborough Creek

The single specimen from Waipipi is flatter than the Castlecliff and Kai-iwi specimens and shows slight differences in the hinge. The type of sculpture possessed by *D. greyi* is developed by many shells on weathering, so that a number of identifications of this species have been made from Oamaruian localities. Of the specimens examined by the writer no true *D. greyi* was seen at a lower horizon than the Wanganuian or Pliocene.

Dosinia (Kakahuia) suteri n. sp. (Figs. 23, 27).

For description see the subgeneric diagnosis given above. The margins are smooth but the pallial line is obscured in the single specimen available.

Holotype in the collection of N.Z. Geological Survey.

Height 22 mm., length 25 mm., thickness (one valve) 6·5 mm.

Locality: 164, greensands overlying coal-beds, Kakahu. (= *Cytherea chariessa,* Suter 1921, p. 53.)

The identification as *C. chariessa* was made without exploring the hinge which was embedded in a hard matrix. This has now been cleared and the teeth as well as the smooth margin show that the shell is related to *Dosinia.*

(2) SUBFAMILY MERETRICINAE.

1. Genus PARADIONE Dall, 1909 (= *Chionella* Cossmann).

Type: *Cytherea ovalina* Lamarck.

Shell rather small, ovate-trigonal. Lunule shallow, bounded by an incised line, no escutcheon. Surface almost smooth, polished, with

obsolete fine concentric folds, also irregular growth furrows, on young shell. are fine regular concentric ridges. Left valve with narrow anterior cardinal joined above to broader, triangular, bevelled median; posterior cardinal fairly long, reaching almost to hinge-margin separated from nymph by very narrow groove and slightly diverging at its lower end, anterior lateral fairly long and strong, diverging from near the top of the anterior cardinal, left valve with rather narrow, grooved posterior cardinal, paired median and anterior cardinals and deep anterior pit with laterals. Pallial sinus fairly deep, broadly rounded at the end, directed at the upper part of the anterior adductor, valve margins smooth.

Paradione differs from *Macrocallista* in so many ways that it should be generically separated. The left anterior cardinal of *Macrocallista nimbosa* Solander is fairly strong, triangular and grooved, the median is very little broader and rugose and the posterior one is extremely narrow and is joined to the nymph without an intervening groove, also the two front teeth slope strongly backwards. In the right valve the posterior cardinal is very narrow and does not nearly reach the hinge-margin, both the median and anterior teeth are directed backwards. The typical *Macrocallista* further differs from *Paradione* greatly in size and shape, the pallial sinus is truncated at the end and horizontal, and the pedal retractor is well separated from the anterior adductor.

Iredale (1924, p. 210) in rightly banishing *Macrocallista* from Autralian usage was not correct, however, in stating that this generic name was given to an American fossil. By monotypy *Macrocallista* Meek (1876, p. 179) is based on *Venus gigantea* Gmelin = *V. nimbosa* Solander.

Subgenus **Notocallista** Iredale, 1924.

Type: *Cytherea kingi* Gray.

Notocallista differs only in minor details from *Paradione ovalina.* The shells of both groups are of the same size and shape, the hinge-teeth are almost identical and the pallial sinus in the earlier species is the same. In sculpture there is no great difference. The recent *P. multistriata* has generally fine, regular concentric ridges, but in many of the specimens from Castlecliff and the Middle Tertiary the ridges are obsolete over a large part of the disc. The young *P. ovalina* of 1 cm. length has practically the same sculpture as the adult *P. parki*. *P. ovalina* differs from any of the southern species in being more polished, in having irregularly-placed growth furrows and in the pedal retractor being joined to the anterior adductor.

Key to Species.

(1.) Pallial sinus truncated	*multistriata*
(2.) Pallial sinus rounded	*parki*
(3.) Shape subtriangular, beaks almost median	*trigonalis*

Paradione (Notocallista) multistriata (Sowerby) (Figs. 70, 71, 72).

1851 *Cytherea (Callista) multistriata* Sow., *Thes. Conch.*, vol. 2, p. 628, pl. 136, fig. 177.

1873 *Callista disrupta* Desh., Hutton, *Cat. Tert. Moll.*, p. 21 (not of Desh.).

1893 *Cytherea assimilis* Hutton, *Macleay Mem. Vol.*, p. 81, pl. 9, fig. 89 a, b. (not of Hutton, 1873).

For further synonymy see Suter's *Manual*, p. 982.

The shape of this shell is somewhat variable and it is possible that more than one species is represented, but a good series of recent examples is lacking. The original type is a somewhat gibbous shell with high beaks. E. A. Smith in the Challenger Report figured and described a flat, oval variety, but did not propose a separate name. In the Castlecliff beds, both of these types and many other variations in shape are represented. The flat form was often called *Macrocallista assimilis* by Suter, but the type of that species has a crenulated margin and is related to *Tawera spissa* (Quoy and Gaimard).

Localities: Recent (type); Landguard Bluff, Wanganui; Castlecliff; Ngaruroro River; Hawera Beach.

Paradione (*Notocallista*) *parki* n. sp. (Figs. 66-69).

Shell rather small, sub-oval, moderately inflated; beaks about anterior third, prominent. Lunule long, sagittate, striated; escutcheon not definitely marked except by a weakening of the sculpture. Sculpture of very fine, close, concentric riblets often obsolete on centre of disc where shell has shining appearance. Hinge-plate long; right valve with anterior and median cardinals of equal strength and semilunar, their inner margins parallel and vertical; posterior cardinal a little longer, but narrow and grooved unequally; anterior laterals parallel to lunular margins. Left valve with anterior cardinal lamellar, almost vertical, joined above to median which is fairly strong, triangular, and bevelled; posterior cardinal short, lamellar, confluent with nymph; anterior lateral fairly long, high, pointed; nymphs slender. Pallial sinus moderate, rounded in front, ascending, directed at anterior adductor or above it.

Holotype (a right valve) in collection of N.Z. Geological Survey.

Height 15·5 mm., length 20 mm., thickness (one valve) 5 mm.

Localities: Parson's Creek, Oamaru, type [J. Park, 1916 (= *M. multistriata* of Suter, 1921, p. 80)]; Awamoa; Target Gully (= *M. assimilis* and *M. multistriata* of Suter, 1921, p. 83); greensand, Wharekuri; Chatton Creek.

This shell, which is not uncommon in the glauconitic sands at the Shell Bed, Target Gully, has always appeared in previous lists as *Macrocallista multistriata* or *M. assimilis*. There are, however, between the Miocene and Recent shells constant differences which warrant specific distinction. In *P. parki*, characteristically a smaller shell, the beaks are more prominent, the posterior is regularly convex and not acuminate, and the pallial sinus is always rounded in front, whereas in *P. multistriata* it is truncate. In *P. parki* the right anterior cardinal is equal in strength to the median, not weaker than it, while the left posterior is sometimes longer than in the recent shell.

Paradione (Notocallista) trigonalis n. sp. (Fig. 73).

Shell small, subtrigonal, plump; beaks high, about anterior third or less, posterior narrowly rounded. Lunule large, lanceolate, little impressed, bounded by shallow line; escutcheon broad, very shallow,

ligamental margins raised. Surface polished, with exceedingly fine, close, concentric ridges becoming obsolete on middle of disc, where there are obsolete radials showing. Hinge strong; left valve with lamellar anterior and posterior cardinals and a triangular, bevelled median cardinal, joined above to anterior one; anterior lateral strong, elongated parallel to lunular margin. Valve-margins smooth.

Holotype in collection of Mr. H. J. Finlay.

Height 17 mm., length 21 mm., thickness (one valve) 5·5 mm.

Locality: 6B, 7C, Clifden, Southland.

Remarks: Easily distinguished by the more posterior position of the beaks, giving the shell a subtrigonal shape.

2. Genus PITAR Roemer.

Type: *Venus tumens* Gmelin.

Subgenus **Hyphantosoma** Dall.

Type: *Cytherea carbasea* Guppy.

Previously, *Hyphantosoma* was known only from the West Indian region where it has lived at least since the Oligocene (Woodring, 1925, p. 153, pl. 20, figs. 15-19). It is therefore surprising to find shells which must be referred here occurring in the Mid-Tertiary of New Zealand. The writer was dubious about this classification when he first made it several years ago; but the recent publication of Woodring's excellent figures of the genotype, and the acquisition, through the kind offices of Dr. K. van W. Palmer of Ithaca, N.Y., of specimens from the type locality, have placed the matter on a good foundation. The New Zealand shell is smaller than *P. carbasea* which comes from the Bowden formation (Miocene) of Jamaica; but it agrees closely in shape, lunule, escutcheon, sculpture and hinge. Minor differences exist; the right posterior cardinal is a shade broader; the anterior lateral pit is longer, and the sculpture is much weaker. These are only of specific significance.

Pitar (Hyphantosoma) sculpturatus (Marshall). (Figs. 74-76.)

1918. *Macrocallista sculpturata* Marshall, *Trans. N.Z. Inst.*, vol. 50, p. 272, pl. 21, figs. 6, 6a.

Lunule large, lanceolate, bounded by a shallow groove. Sculpture of faint, zig-zag grooves on the anterior.

Hinge narrow, only slightly arched. Right valve with fairly broad, well-grooved posterior cardinal; median cardinal short, semi-circular in cross-section, not reaching top of hinge; anterior cardinal paired with median but placed higher up on hinge. Lower part of anterior cardinal projecting over deep groove leading from between two front cardinals to anterior lateral pit, which also is deep and has a weak lateral tooth above and one below. Left valve with posterior cardinal slightly separated from nymph; median cardinal bevelled, not grooved, joined above to lamellar anterior cardinal. Anterior lateral strong, slightly converging anteriorly with the lunular margin. Pallial sinus moderate, ascending, rounded at extremity. Valve-margins smooth.

Localities: Pakaurangi Point, Kaipara; bed 6A, Clifden, Southland.

All of the Clifden specimens seen have narrower and higher beaks than the type; but in the Geological Survey collection from Pakaurangi Point is a specimen which has much the same outline as the southern ones. When the species was first proposed, the hinge was not correctly described, a mistake having been made in the identification of the teeth.

3. Genus CALLISTINA Jukes-Brown.

Type: *C. plana* Sowerby.

Subgenus **Tikia** n. subgen. (from Tiki — one of the first men according to Maori myth).

Type: *Callista thomsoni* Woods.

Shell large, oval, strong. Lunule rather deeply impressed, clearly defined by the bounding ridge, but with no incised line; escutcheon deep, smooth. Sculpture of strong, distant, bevelled ridges with concave interspaces. Left valve with very long thin posterior cardinal joined to nymph, median cardinal of moderate strength, bevelled, not grooved, joined above to anterior cardinal which is laminar, anterior lateral tooth extremely long, the posterior half swollen, thicker and slightly higher than the anterior part; right valve with long, strong, triangular, broadly-grooved posterior cardinal, stout, triangular, unequally-divided median and short laminar anterior cardinal, anterior lateral pit long, broad, and deep, communicating by broad, ogee curve, with space betwen two front cardinals. Valve margins smooth.

This shell was classed as *Callista (Callistina)* by Woods (1917, p. 32), but *Callista* can be used in this sense only by a disregard of the rules of priority, for it was first employed binomially by Gray for *Venus verrucosa* L. and so is a synonym of *Clausina* Brown, one of the *Antigona* group of genera. *Tikia* resembles *Callistina* in the very long left posterior cardinal separated from the nymph by a groove in the broad area in front of the cardinals, also in the shape and disposition of the cardinals themselves. It differs, however, in the extremely long left anterior lateral with its high knobbed posterior end, and in the huge left anterior pit. The sculpture of strong concentric ridges is also distinct from *Callistina,* but there seems to be a connexion through *C. wilckensi* which has ridges on the early shell becoming obsolete later.

Callistina (Tikia) thomsoni (Woods). (Figs. 55, 56).

1917. *Callista (Callistina) thomsoni* Woods, *N.Z. Geol. Surv. Pal. Bull. No. 4,* p. 32, pl. 17, figs. 4, 5, 6, 7.

Figure 7 of Woods represents a specimen with well-preserved sculpture of distant ridges. The writer can find no grounds for separating this from *C. thomsoni,* traces of the same sculpture of distant strong ridges remain on the types and the difference in height of the umbos can be accounted for by the decorticated condition of the original of figure 6. The difference of outline is not so apparent in the specimens themselves as in the figures.

The hinges of Woods's syntypes have now been cleared of the hard matrix and are figured below.

Locality: 587, Selwyn Rapids (Upper Senonian).

Callistina (Tikia) wilckensi (Woods) (Fig. 57.)

1917. *Callista (Callistina) wilckensi* Woods, *N.Z. Geol. Surv. Pal. Bull. No. 4*, p. 31, pl. 15, fig. 8; pl. 16, figs. 10, 11; pl. 17, figs. 1, 2, 3.

This species differs from typical *Tikia* in that the sculpture becomes obsolete on later stages of the shell. The hinge figured by Woods, pl. 15, fig. 8, is the cast of a right valve which is not quite the same thing as a left valve. The true left valve probably has a much less-prominent and less-separated posterior cardinal and a lateral without the posterior hook shown in Woods's figure.

Locality: 589, Selwyn Rapids (Upper Senonian).

4. Genus Finlaya nov.

Type: *Finlaya parthiana* Marwick.

Shell suboval, lunule concave, no escutcheon. Sculpture of weak concentric grooves. Hinge with very broad, triangular left median cardinal joined above to lamellar anterior cardinal. Anterior lateral tooth large, smooth, far distant from the anterior cardinal. Posterior lateral strong in both valves. Pallial sinus moderate, scarcely ascending, valve margins smooth.

Finlaya parthiana n. sp. (Figs. 60-62.)

Shell only moderately strong, well inflated. Lunule large, concave, not bounded by incised line; escutcheon not sunken. Sculpture of concentric grooves obsolete on middle of disc. Left hinge with narrow posterior cardinal joined to nymph; median cardinal very broad, bevelled, triangular, grooved only at apex; anterior cardinal lamellar, joined above to median; anterior lateral strong, smooth, well separated from dorsal margin by groove. Right hinge with moderately strong, curved, grooved posterior cardinal; median cardinal triangular, somewhat narrow; anterior cardinal small, paired with median; anterior lateral pit separated from cardinals by long smooth space; posterior lateral strong, separated by deep groove from dorsal margin. Nymphs somewhat rugose. Pallial sinus moderate, truncated, slightly ascending. Valve-margins smooth.

Holotype in collection of Mr. H. J. Finlay.

Height, 38 mm.; length 43 mm.; thickness (one valve) 10 mm.

Locality: Boulder Hill, near Dunedin; Measly Beach, Wangaloa.

The writer at first classed this shell under *Dosiniopsis* Conrad, which was the only Venerid possessed of a posterior lateral tooth. The genotype, *D. lenticularis* Rogers from the Eocene of eastern North America is of circular shape and has a deep escutcheon. Several species from the Eocene of Europe have a more oval shape and lack the deep escutcheon, *D. fallax* (Desh.) being in shape very like the New Zealand shell. A comparison of *F. parthiana* with specimens of *D. lenticularis,* however, showed such important differences, that a separate genus was required. The chief peculiarities of *Finlaya* as distinct from *Dosiniopsis* are: the great distance separating the anterior lateral tooth from the cardinals; the broad bevelled median cardinal, and very narrow anterior one in the left valve; the large left posterior lateral, well separated from the dorsal margin; and the absence of an escutcheon.

(3) Subfamily VENERINAE.

KEY TO GENERA AND SUBGENERA.

(1) Anterior lateral tooth or tubercle in left valve.	
A. Lateral very strong, marginal crenulations fairly strong	*Kuia*
B. Lateral moderate to tubercular.	
1. Hinge narrow, left median cardinal joined to anterior, right posterior cardinal extremely broad and deeply divided, lunule very large, pouting, marginal crenulations very fine	*Marama*
2. Hinge narrow, left median and anterior cardinals not joined, escutcheon well marked, posterior end abruptly truncated, right posterior cardinal much stronger than median, marginal crenulations very fine.	(*Hina*)
3. Hinge broad, right posterior cardinal not much stronger than median, anterior tubercle often obsolete, marginal crenulations fairly strong......	*Dosinula*
(2) No anterior lateral tooth or tubercle in left valve.	
A. Sculpture of thin, high, spaced, concentric lamellae.	*Bassina*
B. Sculpture of strong, recurved, spaced, concentric ridges	*Clausinella*
C. Sculpture of rather fine, rounded, sometimes crowded, sometimes spaced, concentric ridges	*Tawera*
D. Shell very small, sculpture of thin, spaced, concentric lamellae	*Turia*
E. Sculpture of low radial ribs crossed by irregular concentric lamellae	(*Austrovenus*)
F. Sculpture of fine, crowded, concentric lamellae, sometimes waved to produce fine radials, posterior marginal groove of right valve with a lateral tooth below it.	(*Hinemoana*)

1. Genus KUIA n. gen.

(from Kui an early South Island Maori Chief.)

Type: *Chione vellicata* Hutton.

Shell ovate-trigonal. Lunule large, bounded by an incised line; escutcheon fairly deep. Sculpture of concentric, spaced lamellae generally with radial threads on the lower sides, but not on interspaces. Left hinge with posterior cardinal joined to nymph but much higher; median cardinal narrow and bifid; anterior stoutly triangular with shallow groove on lower surface; anterior lateral high and strong, somewhat compressed. Right hinge with posterior cardinal short, very broad, deeply and widely divided; median laminar, bifid; anterior laminar entire, widely divergent; anterior pit deep with weak lateral above and below. Pallial sinus moderate, acute, ascending. Pedal retractor separated from anterior adductor. Valve-margins finely regularly crenate.

This genus belongs to a group comprising *Antigona* Schumacher, *Periglypta* Jukes-Browne (= *Cytherea* Bolten), *Ventricola* Roemer, *Ventricoloidea* Sacco, *Artena* Conrad, etc., the classification of which is

much confused. The shells are of oval shape and have an anterior lateral tooth or tubercle in the left valve with a corresponding pit in the right; the sculpture consists of regular concentric lamellae or ridges, sometimes reticulated by radial ribs, and the valve margins are crenulated. Dall considered that the anterior lateral tubercle was a true decadent lateral tooth of the same origin as the lateral tooth of *Macrocallista*, and said that it was an "excellent index to important anatomical differences." He therefore classed the group under the genus *Cytherea* Bolten (type *V. puerpera* L.) recognizing many subgenera and sections, and put it in the subfamily *Meretricinae*. Iredale (1914, p. 668) showed that *Cytherea* Bolten was preoccupied and that *Antigona* Schumacher (type *Antigona lamellaris* Schum.) was the oldest name for the group.

Later, Jukes-Browne (1914, pp. 71 and 76) pointed out that the anatomical differences supposed by Dall to be correlated with the lateral tooth had not been demonstrated; so taking into account the other shell characters he thought that *Antigona* was more closely related to the Venerinae. Yet he was content to leave the genus in the Meretricinae so as to facilitate the division into two subfamilies according to the presence or absence of an anterior lateral tooth. In doing so he made the extraordinary statement "our genera are established for the sake of convenience in classification and not for the purpose of expressing a theory." Surely our classifications are the expression of theories of relationship. If they are not they can hardly claim to be "Natural" Science.

Cossmann, following Roemer and Fischer, did not grant the anterior tubercle generic significance, the shells concerned being classed as subgenera of *Chione*, which thus included even such as *Ventricoloidea* Sacco, type *V. multilamella* Lamarck.

It may be mentioned here that in his revision of the Veneridae Jukes-Browne overlooked *Ameghinomya* Ihering, 1907 (type *Ch. argentina* Iher.) which closely resembles *Periglypta*.

The Tertiary rocks of New Zealand are fairly rich in shells which are related to *Antigona*, and the species, *Kuia vellicata* (Hutton), has an extremely strong lateral tooth, stronger indeed than some of the cardinals. An examination of the young stages of these shells shows that the anterior lateral in the *Antigona* group has an origin quite different from that of the Meretricinae. In *Macrocallista* the left anterior lateral is the continuation of a low ridge proceeding from below the umbo, diverging from and in no way connected with the anterior cardinal. This is shown very clearly in *Grateloupia* and *Macrocallista*. In *Antigona* and its allies, however, the left anterior cardinal is triangular and it is the anterior prolongation of this tooth along the hinge-margin which has given rise to the lateral tooth. This is clearly revealed in the ontogeny of species of *Kuia* figured below.

This difference in origin of the lateral tooth of *Antigona* from that of *Macrocallista* harmonises with the other shell characters, such as ornamentation, crenulation of the margins, and arrangement of the cardinal teeth which in *Antigona* resemble those of the Venerinae.

The use of a single genus to cover the whole of this group emphasises a unity of relationship that may not accord with the facts, for the development of the anterior lateral tubercle could take place in parallel groups. Further, so many diverse and easily-distinguished forms are included that the classification of all under *Antigona* is

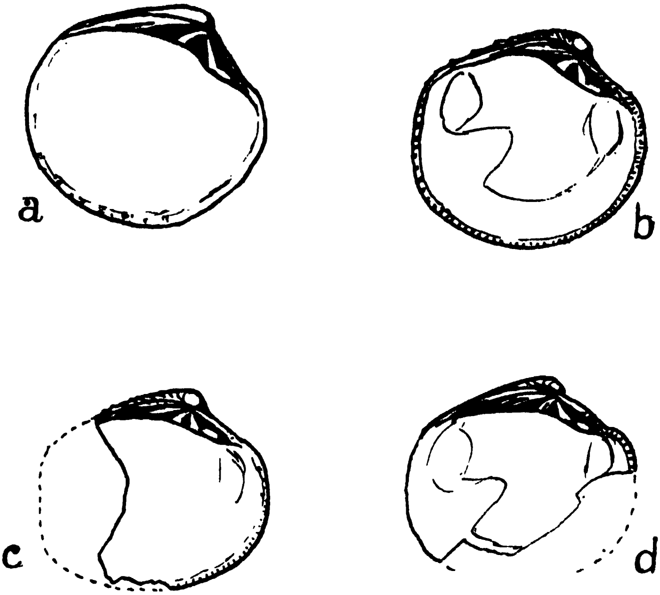


FIG. 2.—*Kuia vellicata* (Hutton) Target Gully, showing stages in the development of the anterior lateral tooth. *a*, 1.5 mm. long; *b*, 2.25 mm.; *c*. 3 mm.; *d*, 5 mm.

clumsy. It seems better to grant generic rank to most of the subgenera and sections recognised by Dall.* Jukes-Browne synonymized *Ventricoloidea* Sacco with *Artena* Conrad, but the two are easily separated. The anterior lateral tooth of *Ventricoloidea multilamella* Lamk. is strongly developed, in *Artena staminea* Conrad it is the merest tubercle. Other differences are shape, sculpture, and arrangement and relative strength of the cardinal teeth.

The new genus *Kuia* described above possesses much in common with *Ventricoloidea* indeed Cossmann (in Marshall 1917, p. 462) has already classed the type, *K. vellicata* in that genus. There are, however, important differences which indicate that relationship is not so close as the external resemblances might lead one to suppose. The median cardinals of *Kuia* are both very narrow and bifid, but those of *Ventricoloidea* are thick, especially that of the left valve which, further, is not divided. The right posterior cardinal of *Kuia* is much shorter and stouter than that of *Ventricoloidea* and the divergence of the two right anterior cardinals is very much greater so as to accommodate the very strong left anterior cardinal.

Key to Species.

A. Sculpture of raised, concentric lamellae.
  1. Beaks prominent, posterior end truncated .... *vellicata*
  2. Beaks not very prominent, shell oval .... *singularis*
B. Sculpture of concentric grooves separating polished interspaces, low lamellae only near lunule .... *macdowelli*

Kuia vellicata (Hutton). (Figs. 92-95.)

1873 *Chione vellicata* Hutton, *Cat. Tert. Moll.*, p. 21.
1886 *Venus meridionalis* Sowb. Hutton, *Trans. N.Z. Inst.*, vol. 18, p. 362, (not of Sowb.).
1914 *Chione meridionalis* (Sowb.), Suter, *N.Z. Geol. Surv. Pal. Bull., No. 2*, p. 51, pl. 14, fig. 4.
1917 *Chione (Ventricoloidea) vellicata* (Hutton), Cossmann in Marshall, *Trans. N.Z. Inst.*, vol. 49, p. 462.
1917 *Cytherea (Circomphalus) chariessa* Suter, *N.Z. Geol. Surv. Pal. Bull., No. 5*, p. 74, pl. 10, figs. 3, 4.

It will be seen that while Hutton and Suter considered this shell to be the South American *C. meridionalis*, Cossmann was quite opposed to them. The lectotype of *K. vellicata* from Awamoa, is a decorticated left valve, embedded in an extremely hard matrix which conceals most of the hinge and indeed the whole interior. An anterior lateral tooth has, however, been disclosed on excavation. Topotypes also show that this shell is certainly not a *Chione* (except in the sense of Fischer and Cossmann) for there is a strong anterior lateral in the left valve and a deep pit, with a lateral above and one below, in the right valve. The specimens handled by Cossmann were from Target Gully and so in a fine state of preservation. He said that they had no analogy with *C. meridionalis* and placed them under *Ventricoloidea.*

C. meridionalis belongs to *Ameghinomya* v. Ihering, and so is but distantly related to *K. vellicata.*

The right posterior cardinal of *K. vellicata* is deeply grooved along its entire length; the median laminar but bifid; the anterior entire and widely diverging from the median. The left anterior cardinal is thick and strong, triangular in cross section, with a high point, and often vaguely grooved on the ventral surface; the left median cardinal is very narrow, and deeply bifid. Both Hutton and Suter mention radial sculpture on this shell and, indeed, this was the main reason for synonymizing with *C. meridionalis.* The radials, shown so clearly by the holotype of *K. vellicata* are merely the internal structure revealed by weathering, a feature liable to be developed on all shells with a crenulated margin. There is no trace of radial sculpture on well-preserved specimens except on the lower surface of the laminae.

Specimens from Target Gully were identified by Suter at different times as *Chione meridionalis, Cytherea sulcata,* and *Cytherea subsulcata*; obviously his conception of these species was extremely confused.

Hutton's syntypes from the various localities mentioned by him in 1873 are no longer available, but it is practically certain that more than one species was represented.

The writer was at first inclined to let *K. chariessa* stand as a separate species because of its fine sculpture, but an extensive series

of Oamaru specimens kindly lent by Mr. H. J. Finlay, shows that his opinion that the Otiake shells are conspecific with *K. vellicata* is well founded.

Localities: Awamoa (type); Pukeuri; Target Gully, Oamaru; Ardgowan, Oamaru; Otiake; Trig Z., Otekaike, Waitaki Valley.

Kuia macdowelli n. sp. (Figs. 98-100.)

Shell fairly large, strong, inflated, oval; beaks prominent at anterior fourth. Lunule well impressed, large, cordate, bounded by incised line; escutcheon well impressed, bounded by ridge. Sculpture of concentric grooves with wide, flat, polished interspaces, covered by very fine concentric lines and often microscopic radials, upper edges of grooves raised into low lamellae near lunule. Right hinge with huge bifid posterior cardinal; laminar vertical, grooved median; and narrow anterior cardinal parallel to lunular margin and strongly divergent from median; anterior lateral pit deep, with low teeth on each side, and connected by groove with space between two front cardinals. Left hinge with strong, curved, posterior cardinal joined to nymph; median cardinal narrow, bifid; anterior cardinal triangular, entire, strong and close to median; anterior lateral well developed, elongated parallel to lunular margin. Nymphs shallow with sloping ligamental surface. Valve-margins crenulated.

Type in collection of Mr. H. J. Finlay.

Height, 40 mm., length 47 mm., thickness (one valve) 15 mm.

Localities: 6D, 7C, 8B Clifden, Southland.

At Blue Cliffs, Southland, is a smaller variety with a less produced anterior end.

Kuia singularis n. sp. (Figs. 96, 97.)

Shell of moderate size, oval, not inflated; beaks low, at anterior third, anterior and posterior margins broadly convex. Lunule long, lanceolate, little impressed, bounded by incised line; escutcheon well impressed, bounded by fairly strong ridge. Sculpture of close concentric lamellae, higher towards the front. Hinge long, left valve with three narrow, widely-divergent cardinals; median narrow, bifid; anterior lateral elongated, but low. Valve-margins finely crenate.

Type in collection of Mr. H. J. Finlay.

Height 27 mm., length 34 mm., thickness (one valve) 10 mm.

Locality: Mussel Beach, Southland.

2. Genus MARAMA n. gen.

(from Marama = Maori moon-goddess.)

Type: *Marama murdochi* Marwick.

a. Subgenus **Marama** s. str.

Shell oval, inflated. Lunule oval, very large, anterior part pouting strongly, bounded by incised line; escutcheon inconspicuous. Sculpture of fine regular concentric lamellae densely crowded on type, but on earliest species spaced and high. Left hinge with long, straight, posterior cardinal separated from nymph by groove; median cardinal moderate, slightly bevelled, unequally grooved; anterior one triangular, joined above to median; anterior tubercle not very strong. Right

hinge with very broad posterior cardinal broadly and deeply divided nearly down to level of hinge-plate; median cardinal short, triangular, unequally divided, separated by a space from lunular margin; anterior cardinal short, curved, lamellar, entire; anterior pit small, situated in broad groove extending from between anterior cardinals. Pallial sinus rather short, acute, ascending. Pedal retractor adjoining anterior adductor. Valve margins very finely and regularly crenate.

Marama is easily distinguished from *Kuia* by its weaker left anterior lateral tooth, much stronger median cardinals, and its left posterior cardinal well separated from the nymph. The sculpture is generally finer and the marginal crenulations always so; also the lunule is larger and more pouting, but the escutcheon is smaller.

b. Subgenus **Hina** n. subgen. (from Hina—Maori moon-goddess).

Type: *Marama pinguis* Marwick.

Shell ovate trigonal, posterior broadly truncated. Lunule not impressed, lanceolate, large, bounded by incised line; escutcheon fairly deep and broad, bounded by a ridge. Sculpture of fine, erect, well-spaced concentric lamellae. Hinge narrow, left valve with long, curved, high posterior cardinal well separated from nymph; broad, widely grooved median cardinal; and short rather broadly triangular anterior one; anterior lateral moderate. Right valve with fairly strong, curved, broadly-grooved posterior cardinal; fairly-strong triangular grooved median; and lamellar anterior one; anterior pit small, situated in groove continued from space between two front cardinals. Pallial sinus short ascending, angular. Pedal retractor confluent with anterior adductor. Valve-margins very finely regularly crenate.

Hina differs from *Marama* in its less oval and more trigonal shape, in the absence of the large oval lunule pouting strongly at its anterior end, the truncation of the posterior end, and the well-developed escutcheon. The two front cardinals of the left hinge are not joined together and so the right median cardinal is of normal length.

The hinge of *Hina* is almost the same as that of *Antigona lamellaris*, but of course the sculpture and lunule are quite different. *Ventricoloidea* has a thicker undivided left median cardinal and a shorter, less-divided posterior right one. In both *Ventricoloidea* and *Antigona* the pedal retractor is well separated from the nymph.

Key to Species.

(1) *Marama*: Shell oval, much inflated, lunule very large, oval, pouting strongly in front, two left front cardinals joined above.

A. Under 25 mm. long, beaks strong, lamellae strong and high 1-2 mm. apart .... *pristina*

B. Over 40 mm. long.

1. Sculpture of well spaced but weak and low lamellae about 1 mm. apart .... *ovata*
2. Shell globose, sculpture of fine close lamellae 3 or 4 per mm. .... *murdochi*
3. Sculpture of high, strong, spaced ridges ...... *hurupiensis*

(2) *Hina*: Shell ovate trigonal, posteriorly truncated, moderately inflated; lunule lanceolate, two front left cardinals not joined above.

A. Sculpture of strong spaced lamellae.	
1. Pallial sinus very short, almost right angled, median cardinal rather wide	*pinguis*
2. Pallial sinus short but acute, median cardinal moderate	*mackenziei*
B. Sculpture of weak spaced lamellae.	
1. Ligamental margin of escutcheon not raised.	
(*a*) Shell about 30 mm. long	*williamsi*
(*b*) Shell about 20 mm. long	*vaga*
2. Ligamental margin of escutcheon raised	*hendersoni*
C. Sculpture of extremely fine dense lamellae, shell globose	*tumida*

Marama pristina n. sp. (Figs. 105, 106.)

Shell somewhat small, longitudinally oval. Lunule large, broadly lanceolate; escutcheon shallow, fairly broad, marked in right valve by cessation of concentric lamellae. Sculpture of high, well-spaced somewhat irregular lamellae 1 to 1·5 mm. apart. Hinge narrow; right valve with fairly long and broad posterior cardinal very widely and deeply grooved leaving only two narrow ridges; median cardinal short, triangular, bevelled; anterior cardinal short, thick, curved; anterior pit fairly well marked, situated in broad groove extending from space between two front cardinals. Valve margins finely crenate.

Holotype in collection of N.Z. Geological Survey (deposited by Dr. P. Marshall).

Height 16 mm., length 22 mm., thickness (one valve) 6·5 mm.

Locality: Greensand, McCulloughs Bridge, Waihao River (= *Cytherea* sp. of Marshall and Murdoch, 1923, p. 118).

Marama ovata n. sp. (Figs. 101, 104).

Shell fairly large, thin, oval. Lunule very large, oval, bounded by incised line; escutcheon broad and shallow in right valve, with raised ligamental margin. Sculpture of distant, low, regularly-spaced lamellae, towards margin lamellae are very fine and densely crowded. Hinge of right valve with large posterior cardinal, deeply and broadly divided almost down to level of hinge-plate leaving only two sharp ridges; median cardinal short, triangular, unequally grooved; anterior cardinal short, curved, lamellar; anterior pit small with weak laterals, situated in broad deep groove extending from space between two front cardinals; hinge-margin raised into strong ridge below pit. Pallial sinus somewhat narrowly acute, ascending, reaching about one-third across shell. Pedal retractor touching the anterior adductor. Valve-margins very finely crenate.

Holotype in the collection of the N.Z. Geological Survey.

Height 33mm., length 42 mm., thickness (one valve) 13 mm.

Localities: Road cutting, Pukeuri, Oamaru; Blue sandstone, Rifle Butts, Cape Wanbrow, Oamaru.

This species is easily distinguished from *M. williamsi* and *M. mackenziei* by its longitudinally-oval shape. The specimen from Rifle Butts is only about 30 mm. long.

Marama n. sp. A.

At Mt. Harris and Pukeuri is a related species much larger, more circular, and with a deeper lateral pit than *M. ovata*, but with similar sculpture. Fragments were identified by Suter (1921, p. 64) as *Cytherea oblonga* Hanley and *Dosinia greyi* Zittel. No complete shell is yet available so complete specific description is held over.

Marama hurupiensis n. sp. (Figs. 125, 126).

Shell large, inflated, oval; beaks fairly prominent, at about the anterior fifth. Lunule extremely large, broadly lanceolate, striated, pouting strongly, bounded by incised line; escutcheon fairly broad, finely striated, ligamental edge slightly raised. Sculpture consisting of regular, concentric lamellae, about 1 mm. apart for the first 25 mm., but from then, especially posteriorly, much stronger, higher, and about 2 mm. apart with from four to six rough concentric lines in the interstices. Pallial sinus small, acute, ascending. Valve margins thickened, finely crenate.

Holotype in the collection of the N.Z. Geological Survey.

Height 45 mm., length 53 mm., thickness (one valve) 15·5 mm.

Localities: 1037, Mouth of Hurupi Creek, N.E. corner Palliser Bay; ? 756, Orepuki, Southland, an incomplete and therefore doubful specimen, slightly more inflated than the type.

Remarks: All the specimens are closed individuals, so the hinge-line could not be seen. Characterized by large size, strong shell, strong sculpture, and huge lunule making front of shell angular.

Marama murdochi n. sp. (Figs. 110, 112-4).

Shell large, almost globular, rather thin. Lunule oval very large, pouting strongly and extending nearly to anterior end of shell; escutcheon weak to absent. Sculpture of very fine, low, concentric lamellae, about 3 per mm. Hinge-plate narrow; left valve with long, straight posterior cardinal separated from nymph by groove; median cardinal moderate, unequally divided; anterior one triangular joined above to median; anterior lateral tubercular, fairly strong. Right valve with very large posterior cardinal, deeply and broadly divided into two ridges; median cardinal much smaller, triangular, unequally grooved; anterior cardinal narrow, entire; anterior pit fairly deep, communicating with space between front cardinals by shallow groove. Pallial sinus rather short, narrowly acute, ascending. Pedal retractor touching the anterior adductor. Valve-margins very finely and regularly crenate.

Holotype in the collection of the N.Z. Geological Survey.

Height 37 mm., length 43 mm., thickness (one valve) 15 mm.

Localities: 1173, Mouth of Waihi Stream, Hawera Beach (G. H. Uttley Coll.) type; 875, Waingongoro River Mouth, near Manaia, Taranaki (= *Cytherea oblonga* Suter, 1921, p. 25); 1096, Clays below limestone, Esk Bridge, Petane (G. H. Uttley).

Easily distinguished by the large size combined with fine sculpture and globose appearance. The great inflation and the incurvature of the umbos have given the hinge a peculiar depressed attitude.

Marama (Hina) vaga n. sp.

Shell rather small, rhomboidal, not much inflated, posterior broadly truncated. Lunule large, lanceolate, bounded by an incised line; escutcheon well defined by rounded ridges. Sculpture of fairly fine, spaced, concentric lamellae, less than 1 mm. apart. Right hinge with fairly broad, curved, widely-grooved posterior cardinal; triangular, moderately sized, grooved median; and lamellar anterior cardinal parallel to the lunular margin; anterior pit scarcely defined, situated in a deep groove proceeding from between two front cardinals. Pallial sinus short, almost right-angled. Pedal retractor adjoining adductor. Valve margins very finely, regularly crenate.

Holotype in the collection of the N.Z. Geological Survey.

Height 19·5 mm., length 22 m., thickness (one valve) 7 mm.

Locality 630 Greensand, McCullough's Bridge, Waihao River (= *Dosinia greyi* of Suter, 1921, p. 79).

Geological Survey collection 630, to which this shell belongs, was formerly supposed to be from the Waiareka Valley, but the writer has shown (Marwick, 1924B, p. 280) that in all probability it is from the Waihao greensand at McCullough's Bridge. Owing to the possibility of error, it might be argued that this shell should not be described, so it is only after a full consideration of the position that a name has been supplied. The specimen is beautifully preserved and certainly belong to the Waimatean stage, so no great harm can come from its specific recognition. Its importance is to show that *Hina* was already separated from *Marama* in Tahuian times.

Figures of this species were accidentally omitted. They will be published next year.

Marama (Hina) n. sp. B.

This shell was collected by Mr. R. S. Allan from the Bortonian greensand at Waihao Downs, but unfortunately the hinge is missing. It cannot, therefore, be referred with certainty to *Hina*, but the general external appearance and the extremely fine crenulations on the margin are very strong evidence in favour of such classification. The pallial sinus is very short, and practically right-angled, which almost confirms the position under *Hina*.

Marama (Hina) pinguis n. sp. (Figs. 90, 91).

Shell of moderate size, inflated, posterior broadly truncated. Lunule large, lanceolate, bounded by incised line; escutcheon well marked, bounded by rounded ridge in left valve, ligamental margin slightly raised. Sculpture of fine, spaced, erect, concentric lamellae 1 to 1·5 mm. apart. Hinge narrow, left valve with posterior cardinal long, high and curved, well separated from nymph; median cardinal short, broad slightly bevelled, widely grooved; anterior cardinal short, stoutly triangular; anterior tubercle moderate, compressed. Pallial sinus very short, angular; adductor impressions narrow, posterior one well away from hinge-plate. Pedal retractor confluent with anterior adductor. Valve-margins regularly, very finely crenate.

Type in collection of N.Z. Geological Survey, deposited by Dr. P. Marshall.

Height 26 mm., length 30 mm., thickness (one valve) 10 mm.

Locality: Pakaurangi Point (= *Dosinia greyi* of Marshall, 1918, p. 274).

Marama (Hina) tumida (Marshall) (Figs. 102, 103).

1918. *Dosinia tumida* Marshall, *Trans.. N.Z Inst.*, vol. 50, p. 271, pl. 21, figs. 4, 4a.

Shell small, fragile, roundly oval, globose. Lunule cordate, very large, pouting; escutcheon shallow, with raised ligamental margins. Sculpture of extremely fine, dense, concentric lamellae about 10 per mm. Left hinge with strong lamellar posterior cardinal separated from the narrow nymph by deep groove; median cardinal short and fairly broad, bevelled, unequally divided; anterior cardinal triangular, curving forward below; anterior lateral moderate, elongated. Pallial sinus short, acute, ascending. Valve-margins very finely crenate.

Height 17 mm., length 19 mm., thickness (one valve) 7 mm.

Locality: Pakaurangi Point, Kaipara.

In the original description, the narrow nymph seems to have been mistaken for a lateral tooth.

M. tumida is easily distinguished from the other species of *Hina* by its small size, extremely fine sculpture and globose form. Externally it is like a miniature *M. murdochi* but the hinge is closer to *Hina* than to *Marama* s. str.

Marama (Hina) williamsi n. sp. (Figs. 109, 111).

Shell of moderate size, triangularly oval. Lunule large, lanceolate, pouting somewhat, bounded by an incised line; escutcheon fairly deep, with raised ligamental margins. Sculpture of distantly spaced, low, sharp lamellae, interspaces finely, somewhat irregularly striate. Left hinge with posterior cardinal separated by groove from nymph; median only of moderate size, bevelled, unequally divided; anterior triangular; anterior lateral rather weak. Pallial sinus short, acute, directed at anterior of hinge. Valve-margins very finely crenate.

Holotype in collection of N.Z. Geological Survey.

Height 27 mm., length 32 mm., thickness (one valve) 9 mm.

Locality: Sandstone near top of section on coast, Campbell's Beach, Allday Bay.

M. williamsi is characterised by its peculiar shape, the posterior margin is truncated but slopes forward from the dorsal margin towards the ventral. It is less inflated than *M. pinguis*, the posterior area is flattened and the concentric lamellae are much scattered. This species is named in honour of Mr. David Williams of Oamaru through whose unfailing kindness the writer has been enabled to visit many fossiliferous localities in North Otago.

Marama (Hina) mackenziei n. sp. (Figs. 88, 89.)

Shell of moderate size, triangularly oval. Lunule large, broadly lanceolate, bounded by incised line; escutcheon fairly deep, in left valve concave with well-defined bounding ridge. Sculpture of well-spaced, high, sharp lamellae, interspaces finely striate. Hinge of left

valve with posterior cardinal separated by deep groove from nymph; median cardinal of moderate strength unequally divided; anterior triangular, curving forward below, anterior lateral tubercular. Pallial sinus short, acute, ascending. Pedal retractor confluent with anterior adductor. Valve-margins finely, regularly crenate.

Holotype in collection of N.Z. Geological Survey.

Height 32 mm., length 26 mm., thickness (one valve) 10 mm.

Locality: 20 chains above mouth of Awamoa Creek.

Distinguished from *M. williamsi* by its different shape and much stronger sculpture and from *M. pinguis* by greater length, slightly stronger sculpture, more acute pallial sinus, narrower median tooth, etc.

The species is named in honour of its collector Mr. L. McKenzie of Enfield.

Marama (Hina) hendersoni n. sp. (Figs. 107, 108).

Shell of moderate size, ovate trigonal, inflated, beaks prominent about anterior fifth. Lunule broadly lanceolate, large, bounded by incised line; escutcheon broad, bounded by low ridges, ligamental margins well raised. Sculpture of regular distant weak concentric lamellae, with wide, flat, striated interspaces. Hinge-plate somewhat narrow, left valve with arched posterior cardinal separated from nymph by groove, median cardinal of moderate strength; anterior triangular not very strong; anterior lateral rather small but sharply raised. Crenulation of inner margin extremely fine and regular.

Holotype in collection of N.Z. Geological Survey.

Height 24 mm., length 28·5 mm., thickness (one valve) 9·5 mm.

Localities: 1150, Tongaporutu River (Mokau Beds) type; 919 Awakino Valley Road (= *Cytherea oblonga* of Suter in Henderson and Ongley 1923, p. 30).

This species resembles *M. mackenziei* in shape, but the beaks are curved more strongly and the sculpture is much weaker, being like that of *M. ovata* with more widely-spaced concentrics. The ligamental margins of the escutcheon are higher than in any of the other species. The shell classed by Suter as *Dentilucina* n. sp. (Henderson and Ongley, 1923, p. 36) is closely related. It is more inflated than the typical *M. hendersoni* and has stronger beaks, but more material is required to show whether another species is represented.

3. Genus DOSINULA Finlay, 1927.

Type: *Dosina zelandica* Gray.

Shell large, oval. Lunule large, impressed, bounded by incised line; escutcheon absent on type, well marked on Mid-Tertiary ancestors. Sculpture of regular, sharp, spaced, concentric lamellae. Left hinge with long, curved, fairly-strong posterior cardinal separated from nymph by deep groove; median cardinal strong, unequally divided; anterior cardinal triangular, strong, faintly grooved; anterior lateral small, tubercular. Right hinge with posterior cardinal fairly strong, grooved, median cardinal about same length, also grooved; anterior cardinal much narrower, entire; lateral pit small. Pallial sinus short, acute. Pedal retractor separated from anterior adductor. Valve-margins thick, crenulated.

Although the sculpture is the same as that of *Kuia* and *Ventricoloidea* the hinge is more closely allied to that of *Periglypta* (= *Cytherea* Bolten). Suter placed *D. zelandica* in *Circomphalus* which he followed Dall in recognizing as a subgenus of *Cytherea*. The type of *Circomphalus*, *V. plicata* Gmelin, has high reflexed lamellae with a double crest along the posterior dorsal area and so cannot be closely related to *Dosinula*. Jukes-Browne associated *D. zelandica* with *Ventricola*, type *V. rugosa* Gmelin, a better classification than Suter's, but still not an accurate one, for the hinge-teeth of *V. rugosa* are short, stout, not well grooved and of a different shape from those of *Dosinula*.

KEY TO SPECIES.

(1) Escutcheon well marked, deep.	
A. Beaks very prominent, posterior area flattened	*D. uttleyi.*
B. Beaks not very prominent, inflation regular over whole disc.	*D. suboblonga*
(2) Escutcheon defined only by absence of concentric lamellae.	
A. Beaks not very prominent, outline oval, dorsal margin descending slowly	*D. zelandica*
B. Beaks very prominent, outline ovate-trigonal, dorsal margin descending rather quickly	*D. crebra.*
C. Beaks not prominent, outline subcircular, pallial sinus rounded at end.	*D. firmocosta.*

Dosinula zelandica (Gray). (Figs 118, 119, 121.)

1835 *Dosina zelandica* Gray, Appendix to Yate's *New Zealand*, p. 309.

1843 *Dosina zelandica* Gray, Appendix to Dieffenbach's *New Zealand*, p. 249, No. 158.

1843 *Dosina oblonga* Gray, Appendix to Dieffenbach's *New Zealand*, p. 249, No. 159.

1874 *Venus oblonga* Gray: Smith, *Zool. of Erebus and Terror*, No. 21, Mollusca, p. 6, pl. 2, fig. 1, pl. 3, fig. 5.

1927 *Dosinula zelandica* (Gray): Finlay, *Trans. N.Z. Inst.*, vol. 57, p. 470.

For further synonymy see Suter's *Manual*, p. 985.

Localities: Recent, type; Castlecliff; Kai-iwi; Okauawa and Maraekakaho Creeks, Ngaruroro River; Nukumaru; Waipipi Beach, Waverley.

Dosinula crebra (Hutton) (Figs. 115-7).

1873 *Chione crebra* Hutton, *Cat. Mar. Moll.*, p. 70.

1880 *Venus crebra* Hutton, *Man. N.Z. Moll.*, p. 147.

1913 *Cytherea crebra* Hutton: Suter, *Man. N.Z. Moll.*, p. 984, pl. 61, fig. 1 (misprinted *creba*).

1923 *Antigona zelandica* (Gray): Oliver, *Proc. Malac. Soc.*, vol. 15, p. 184 (in part).

The writer was formerly of the opinion published by Oliver that Gray had dealt with the two closely-related forms of Recent *Dosinula* when he named *D. oblonga* and *zelandica* thus rendering Hutton's *crebra* unnecessary. An inspection of Smith's figures of Gray's two species shows, however, that Gray did not have *crebra*, but that his

specimens were variants of the common shell distributed throughout New Zealand. Whether *crebra* is specifically distinct from *zelandica* is not clear, but the writer favours their separation. Both forms occur at Lyall Bay, *crebra* being much the commoner, but only *zelandica* has been collected from within Wellington Harbour. The beaks of *D. crebra* are broader and more prominent than those of *zelandica,* the lunule is broader, the sculpture not so high and regular, and the dorsal margin descends more quickly.

Localities: Recent, type; 81, Castle Point.

The fossil occurrence at Castle Point about middle Pliocene is interesting as showing that the differences from *D. zelandica* are not of recent origin.

Dosinula elegans (Hutton). (Fig. 120.)

1873 *Callista elegans* Hutton, *Cat. Tert. Moll.* p. 21.

1886 *Callista elegans* Hector, *Outline N.Z. Geol.*, p. 51, fig. 9, no. 6.

1914 *Chione elegans* (Hutton): Suter, *N.Z. Geol. Surv. Pal. Bull. No. 2,* p. 9.

1918 *Chione (?) elegans* (Hutton): Suter, *Alph. List N.Z. Tert. Moll.*, p. 9.

Shell somewhat small, oblong, not greatly inflated; beaks low, at anterior sixth; dorsal margin almost horizontal; posterior broad, regularly rounded; anterior narrowly convex. Lunule large, lanceolate, striated, pouting strongly, bounded by an incised line; escutcheon very narow. Sculpture of regular concentric lamellae with interspaces of about 1 mm. width. Hinge obscured. Valve-margins finely crenate.

Holotype in collection of N.Z. Geological Survey.

Height 23 mm., length 30 mm., thickness (one valve) 7·5 mm.

Locality: Kanieri.

In his description of the type, Hutton says " distant, concentric, narrow ribs, crossed by fine radiating striae near the umbo." This caused Suter's classification of the shell, which he had not seen, as *Chione.* The radials are revealed only by the weathering of the outer shell layer.

It is doubtful if this species is distinct from *D. zelandica.* The type is the only specimen known and it is in a damaged condition.

Dosinula suboblonga n. sp. (Figs. 124, 127, 130.)

1917 *Ventricoloidea suboblonga* Cossmann in Marshall, *Trans. N.Z. Inst.*, vol. 49, p. 462, nomen nudum.

Shell of moderate size, sub-oval, inflated; beaks fairly prominent, at anterior fifth; posterior dorsal margin broadly curved descending regularly to posterior extremity which is narrowly convex; ventral margin broadly arcuate, anterior somewhat narrowly rounded. Lunule broadly lanceolate, shallow, bounded by incised line, striated; escutcheon broad, fairly deep, bounded by low ridge, striated. Sculpture of regular, concentric, raised, spaced lamellae. Hinge-plate broad, with sinuate margin; left valve with anterior cardinal long, strong, vertical, entire; median cardinal of about the same strength but with approximately parallel sides, divided very unequally by

groove; posterior cardinal curved, laminar, separated from nymph by shallow groove; anterior lateral insignificant, pustular. Right valve with stout bifid posterior cardinal; triangular grooved median and laminar entire anterior one; anterior lateral pit shallow. Muscular impressions very large. Pallial sinus small, angular, nearly horizontal. Valve-margins finely crenate.

Height 40 mm., length 47 mm., thickness (one valve) 15 mm.

Holotype in collection of N.Z. Geological Survey.

Locality: Shell Bed, Target Gully, Oamaru.

Easily distinguished from *D. zelandica* by the deep escutcheon. It has been pointed out to the writer that Cossmann's name is a *nomen nudum* and therefore has no nomenclatural standing. Unfortunately this is the case, but we can still use the specific name which he proposed.

Dosinula uttleyi n. sp. (Figs. 128, 129.)

Shell moderately large, subquadrate, inflated; beaks very prominent, at anterior fourth; posterior dorsal margin slightly curved, descending slowly, sub-angled on meeting the posterior margin which is obliquely truncated; ventral margin broadly, regularly curved; anterior margin narrowly rounded, straightened above and descending at 45°. Lunule large broadly lanceolate, striated; escutcheon fairly broad bounded by ridge, and with slightly raised ligamental margins. Sculpture of distant, thin, raised, concentric lamellae; an obscure ridge runs from umbo to posterior end of ventral margin forming slightly depressed dorsal area. Hinge-plate broad, sinuous; right valve with broad, widely grooved, curved posterior cardinal; broad, unequally grooved median, and short, narrow, lamellar, anterior cardinal; anterior pit moderately deep with obsolete lateral above and weak rugose one below. Left valve with high, curved, strong posterior cardinal, separated from nymph by fairly deep groove; rather broad, weakly grooved, bevelled, median cardinal; and triangular curved anterior cardinal almost as wide below; anterior lateral tubercular. Muscular impressions large. Pallial sinus short, angular. Pedal retractor close to adductor.

Holotype in collection of N.Z. Geological Survey.

Height 50 mm., length 62 mm., thickness (one valve) 18 mm.

Localities: top of limestone, Otiake; Trig. Z, Otekaike River (G. H. Uttley); 7c Clifden.

Distinguished from *D. suboblonga* by more oblong shape, generally larger size and more produced anterior end.

Dosinula firmocosta n. sp. (Figs. 122, 123.)

Shell of moderate size, nearly circular, inflated; beaks at anterior fourth. Lunule broadly lanceolate, little impressed, bounded by incised line, inner margins pouting; escutcheon shallow but marked by weakening of concentric sculpture. Sculpture of distant, strong, recurved, high, concentric lamellae, with about three low fine lamellae in interspaces. Hinge long, fairly straight; left valve with posterior and median cardinals broad and bifid, anterior entire, anterior lateral pit small and shallow, nymph very narrow. Pallial sinus short, ascending, narowly rounded in front. Valve-margins finely crenate.

Holotype in collection of Mr. H. J. Finlay.

Height 41 mm., length 46 mm., thickness (one valve) 13 mm.

Locality: 6B (type) and 7A Clifden, Southland.

Remarks: The concentric lamellae are much stronger than in the other species and the pallial sinus is distinctive in being rounded in front.

4. Genus TURIA n. gen.
(from Turi, an early Maori voyager.)

Type: *Turia chattonensis* Marwick.

Shell very small. Lunule superficial, bounded by incised line; escutcheon shallow. Sculpture of thin, spaced lamellae. Left hinge with posterior cardinal joined to nymph; median triangular, curved, bevelled, scarcely grooved; anterior joined above to median, sloping well forward, produced somewhat along hinge-line. Right hinge with posterior and median cardinals triangular, bevelled, not grooved; anterior cardinal low, narrow and entire. Pallial sinus short, ascending, rounded at end. Pedal retractor well separated from adductor. Valve-margins finely crenate.

Turia differs from *Tawera* in having thin, spaced lamellae instead of strong ridges on its surface; also the teeth are of somewhat different shape and are not so well grooved. The sculpture indeed is the same as that of *Kuia* and *Marama* and the hinge resembles the very young stages of those genera; *Turia* therefore seems to be intermediate between them and *Tawera*.

KEY TO SPECIES.

Sculpture of thin, spaced, concentric lamellae.
- A. Oval, inflated, beaks about anterior third .... *pukeuriensis*
- B. Ovate,trigonal, beaks about anterior fourth
  - 1. About 2 lamellae per mm. .... *waiauensis*
  - 2. About 4 lamellae per mm.
    - *a.* Shell about 10 mm. long .... *bortonensis*
    - *b.* Shell about 5 mm. long .... *chattonensis*

Turia bortonensis n. sp. (Figs. 77, 78).

Shell small, ovate-trigonal, inflated. Lunule lanceolate, pouting, bounded by incised line; escutcheon fairly broad, almost smooth. Sculpture of fine, closely-set concentric lamellae, 4 per mm. Left valve with long, almost straight posterior cardinal; thick, grooved median, and long anterior one, produced along hinge-margin. Pallial sinus obscured. Valve-margins finely crenulated.

Holotype in collection of N.Z. Geological Survey.

Height 8·5 mm., length 10·5 mm., thickness (one valve) 3·5 mm.

Locality: 176, Black Point, Waitaki Valley (= *C. chariessa* of Suter, 1921, p. 72).

Turia chattonensis n. sp. (Figs. 85-7).

Shell very small, ovate-trigonal, beaks fairly prominent. Lunule lanceolate, superficial, bounded by incised line; escutcheon very shallow bounded by weak ridge in left valve. Sculpture of low, spaced

concentric lamellae about 4 per mm. Left hinge with thin posterior cardinal joined to nymph; median triangular, curved, bevelled, scarcely grooved; anterior joined above to median sloping well forward. Right hinge with posterior and median cardinals triangular, bevelled, not grooved; anterior cardinals low, narrow, entire. Pallial sinus short, wide ascending, rounded at end. Pedal retractor well separated from adductor. Valve-margins finely crenate.

Holotype in collection of Mr. H. J. Finlay.

Height 4.5 mm., length 5·2 mm., thickness (one valve) 1·8 mm.

Localities: Chatton Creek, near Gore; 4A Clifden (H. J. Finlay).

Distinguished from *T. bortonensis* by smaller size and greater relative height.

Turia pukeuriensis n. sp. (Figs. 79-81).

Shell very small, longitudinally oval, inflated, posterior margin broadly truncated, anterior convex. Lunule not impressed, broadly lanceolate, bounded by incised line; escutcheon obscure in right valve, moderately broad and smooth in the left; sculpture of spaced concentric lamellae about four per mm. Hinge-line narrow, teeth divergent, right valve with posterior cardinal triangular and grooved; median triangular and entire; anterior entire; left valve with posterior cardinal joined to nymph; median stout and grooved; anterior long, triangular extending well along the hinge margin. Pallial sinus short, ascending, broadly rounded at end. Valve-margins finely crenate.

Holotype in collection of N.Z. Geological Survey.

Height 5 mm., length 6·5 mm., thickness (one valve) 2.5 mm.

Localities: Pukeuri, type; Target Gully; Ardgowan; 6A Clifden, Southland (H. J. Finlay).

As thus constituted the species covers a considerable range in shape, and further subdivision may be advisable. The chief characteristics are the elongate oval outline, somewhat depressed beaks, and great inflation.

Turia waiauensis n. sp. (Figs. 82-4).

Shell small, subtrigonal, beaks high, at anterior third, posterior margin truncated to narrowly rounded, anterior margin narrowly rounded. Lunule large, broadly lanceolate, bounded by incised line; escutcheon broad and shallow, almost smooth. Sculpture of spaced concentric ridges two or less per mm. Hinge-line narrow, cardinals divergent; right valve with triangular grooved posterior cardinal; triangular entire median, and narrow anterior one. Left valve with posterior cardinal lamellar; median broad and grooved; anterior triangular, entire, somewhat curved and produced along hinge-margin. Pallial sinus short and rounded. Valve-margins very finely crenulated.

Type in collection of Mr. H. J. Finlay.

Height 5 mm., length 5·5 mm., thickness (one valve) 2 mm.

Locality: 8a, Clifden, Southland. (H. J. Finlay.)

Differs from the other small species in the wide spacing of the concentric ridges. Externally this shell resembles a young *Kuia vellicata,* but the latter in its youngest stages has the anterior cardinal produced further along the margin and bears the rudimentary lateral denticle.

5. Genus TAWERA n. gen..

(from Tawera, the Maori for "Venus as morning star.")

Type: *Venus spissa* Deshayes.

Shell oval. Lunule not impressed, bounded by incised line; escutcheon insignificant in type but stronger in ancestral forms; ligament exposed. Sculpture of bevelled, smooth, concentric ridges low and crowded on type but on some species high and spaced; sometimes radials corresponding to the marginal crenulations are developed, especially on lower side of ridges. Hinge-teeth widely divergent; left valve with long, high, posterior cardinal joined to nymph; moderate, bevelled, fairly-deeply but unequally divided median; and long, entire, triangular, widely-diverging anterior one, outer side of which tends to run forward along hinge-margin. Right valve with broadly-grooved posterior cardinal of moderate strength; median triangular, bevelled, rather weakly grooved; anterior one entire, parallel to lunular margin. Pallial sinus short, truncated, ascending. Valve-margins crenate.

Suter, Jukes-Browne and Iredale classed *V. spissa* in *Chamelea* Moerch (type *V. gallina* Linné) and it is with some hesitation that the writer separates *Tawera* from *Chamelea* generically. The hinge of *Chamelea,* however, is much closer to that of *Clausinella* (type *V. fasciata* Da Costa) which has a different kind of sculpture.

Tawera differs from *Chamelea* in having more divergent teeth; in the left valve the posterior cardinal is much stronger, the median is more transverse and always grooved and the anterior is directed further forward; in the right valve the posterior cardinal is shorter, stronger, more widely grooved and more transverse, the median is better grooved, straighter and vertical, and the anterior cardinal is longer, stronger and directed further forward. The deeply impressed lunule of *C. gallina* gives a different shape to the shell, but this is not a very important character, for in the European Miocene fossil *C. cothurnix* Dujardin the lunule is not impressed.

The East Australian Recent *V. gallinula* Lamk. belongs to *Tawera* which has, moreover, existed in the Australian area from at least Miocene times, as shown by *C. propinqua* Tenison-Woods, occurring in the lower and more commonly in the upper beds at Muddy Creek. *Chioneryx* Iredale, 1924, of which the type is the Australian *Erycina cardioides* Lamarck, is closely related to *Tawera,* and is perhaps a somewhat recent development from that stock. The shape differs from that of *Tawera* in being more compressed posteriorly, with a slight sinus in the posterio-ventral margin. The hinge-teeth are even more widely divergent than those of *Tawera,* the right median being considerably extended anteriorly along the hinge-margin. The dominant sculpture of *Chioneryx* is radial, whereas in *Tawera* it is concentric.

Key to Species.

Sculpture of concentric ridges

A. Under 12 mm. high.

1. Shell inflated, beaks almost central .... *bartrumi*
2. Shell little inflated, beaks at anterior third ...... *marshalli*

B. Over 12 mm. high.

1. Thick concentric ribs well spaced .... *subsulcata*
2. Concentric ribs close.
   - *a.* Beaks almost central .... *errans*
   - *b.* Posterior smooth, shell oval .... *assimilis*
   - *c.* Posterior smooth, shell trigonally oval ...... *wanganuiensis*
   - *d.* Sculpture of close ridges over whole of disc *spissa*

Tawera marshalli n. sp. (Figs. 131-3, 135, 136).

1917 *Chione (Ventricoloidea) marshalli* Cossmann, in Marshall, *Trans. N.Z. Inst.*, vol. 49, p. 462, *nomen nudum.*

Shell small, oval, beaks at anterior third. Lunule long, lanceolate, not impressed, bounded by incised line; escutcheon rather narrow, smooth, bounded by ridge on left valve. Sculpture of fine, regular, rounded, slightly-spaced, concentric ridges, three to four per mm., becoming narrower and crowded on posterior. Hinge-teeth widely divergent, left valve with long posterior cardinal separated from nymph by groove; median rather narrow, narrowly but deeply grooved; anterior cardinal long, triangular, joined above to median, sloping well forward below and produced along hinge-margin. Right valve with somewhat short, triangular, grooved, posterior cardinal; median almost as strong, triangular, bevelled, not grooved, curving forward; anterior cardinal lamellar, almost parallel to lunule. Pallial sinus moderate, ascending, rounded at extremity. Pedal retractor rather large, separated from anterior adductor. Valve-margins finely, regularly crenate.

Holotype in collection of N.Z. Geological Survey.

Height 9 mm., length 11 mm., thickness (one valve) 3 mm.; paratype 12 mm. x 16 mm. x 4 mm.

Localities: Shell-bed, Target Gully; Pakaurangi Point (= *C. meriodionalis* and *P. curta* of Marshall 1918, p. 274).

Suter identified the Target Gully specimens as *C. mesodesma* (Q. & G.), but Cossmann said they had no analogy of shape, ornamentation or hinge with the Pliocene representatives of that species, but belonged to *Ventricoloidea.* Though *Tawera marshalli* is easily specifically separable from *T. mesodesma,* Cossmann's remarks are quite wrong. The shell has no anterior tooth or tubercle and so is not a *Ventricoloidea.* The sculpture is of the same kind as that of *T. mesodesma* but the ridges are more spaced and the hinges agree quite closely. Attenuated specimens with consequently a long hinge-plate show a slight bulge in the hinge-margin caused by the pedal retractor scar; this may have been mistaken by Cossmann for an anterior tubercle.

Tawera bartrumi n. sp. (Figs. 134, 138).

Shell small, ovato-trigonal, somewhat inflated, subequilateral; beaks prominent, almost median, more anterior in youth; anterior end slightly narrower than posterior. Lunule relatively large, lanceolate, superficial, bounded by incised line; escutcheon inconspicuous in right

valve. Sculpture of very fine concentric ridges (five to six per mm.). Hinge-plate moderate; right valve with posterior cardinal fairly broadly triangular, grooved above; median triangular, not grooved, anterior side curving forward along hinge margin; anterior cardinal narrow, parallel to lunular margin. Pallial sinus short, rounded, ascending. Valve-margins finely crenate.

Holotype in collection of N.Z. Geological Survey.

Height 8 mm., length 9·5 mm., thickness (one valve) 3 mm.

Locality: 996, Kaawa Creek (= *Chione mesodesma, C. meridionalis* juv. and *C. spissa* of Bartrum, 1919, p. 104).

Easily distinguished from *T. spissa* by the very fine sculpture, and from *T. marshalli* by the finer sculpture and different shape.

Tawera errans n. sp. (Figs. 139, 140).

Shell of moderate size, rather thin, little inflated, shape inconstant, beaks sometimes almost central, sometimes at anterior third. Lunule long, extremely narrow, bounded by incised line; escutcheon almost absent from right valve, stronger in left, with bounding ridge. Sculpture of narrow, moderately-spaced, bevelled, concentric ridges which die away on the posterior half of the disc. Hinge with very long ligamental grooves, nymphs close to hinge-margin; left valve with long, narrow posterior cardinal separated from nymph by only shallow groove; median moderate, grooved; anterior very long, sloping well forward along hinge-margin. Right valve with very short triangular widely-grooved posterior cardinal; stronger, weakly-grooved median; and rather long, low, lamellar anterior one. Pallial sinus not clearly marked but apparently short and ascending. Valve-margins finely regularly crenate.

Holotype in collection of N.Z. Geological Survey.

Height 21·5 mm., length 26 mm., thickness 6 mm.

Locality: 1101, Waipipi Beach, Waverley.

All the available specimens are somewhat worn so the sculpture is not well preserved. The species is easily distinguished from *T. spissa* by the much longer ligament and shorter hinge-teeth.

Tawera subsulcata Suter. (Figs. 149-51).

1887 *Venus sulcata* Hutton, *Proc. Lin. Soc.,* N.S.W., vol. 1 (ser. 2) p. 226 (in part).

1893 *Venus sulcata* Hutton, *Macleay Memm. Vol.* p. 81, pl. 9, fig. 87 (not of 1875).

1905 *Chione subsulcata* Suter, *Proc. Mal. Soc.* 6, p. 205.

1913 *Cytherea subsulcata* Suter, *Man. N.Z. Moll.* p. 985, pl. 61, fig. 3.

It is difficult to understand why the classification was changed from *Chione* to *Cytherea.* The shell closely resembles *Tawera spissa,* practically the only difference being larger size and coarser-spaced concentric sculpture of *T. subsulcata.* The teeth are the same in both species, and there is not the slightest trace of an anterior lateral tubercle. In his 1905 paper, Suter does not give a full description of the shell, but he says " all finely and closely radially striated, the striae running over the broad concentric ribs." This feature is seen only on the ventral side of the ribs, and it does not occur on all

specimens. Those showing it plainly are from Nukumaru, and they have all a thickened margin, the radials being caused by a continuation across this margin of the crenulations on the inner side. From their inconsistency they do not seem to be worth systematic consideration.

The figure in Suter's *Manual* does not give the true appearance of this species, and was perhaps drawn from a *T. spissa*. The figure in the *Macleay Memorial Volume,* drawn by Suter, gives the correct shape, but the strong ribs are not properly shown.

Suter named as type " *Venus sulcata* Hutton of the Pliocene (1887)" and added that he had good examples from Wanganui and Waikopiro. Hutton in 1887 published a paper on the " Pareora and Oamaru Systems " and under *Venus sulcata* he gives " *Pareora System.*—Napier; Motunau. Found also in the Wanganui System." (*i.e.,* the Pliocene). Suter's designation of a type is therefore quite inadequate. In his paper on the Pliocene Mollusca, Hutton (1893) gave as localities for *Venus sulcata,* Wanganui and Matapiro, therefore a specimen from Nukumaru, a few miles west of Wanganui has been chosen as neotype. It is now in the collection of the N.Z. Geological Survey.

Localities: Okehu; Nukumaru, type; Maraekakaho, Ngaruroro River; 191, Shrimpton's, Ngaruroro River; 188, Kereru, Hawkes Bay; Motunau (Canterbury Museum coll.)

Suter's identifications of *T. subsulcata* are not reliable. Among shells he has attributed to it are specimens of *Kuia vellicata,* Target Gully (1921, p. 81) and *Bassina yatei,* Lower Waipara (1921, p. 45).

No recent specimens have been seen by the writer and their absence from the Kai-iwi and Castlecliff beds points to extinction before Castlecliffian times.

Tawera assimilis (Hutton). (Fig. 137).

1873 *Chione assimilis* Hutton, *Cat Tert. Moll.* p. 21

" Ovate, posterior end slightly rounded, its dorsal margin concave; concentrically striated, the striae higher and broader at the anterior end." (Hutton).

Holotype in collection of N.Z. Geological Survey.

Height 24 mm., length 31 mm., thickness (one valve) 7 mm.

Locality: Wanganui district.

The Holotype and only specimen was not seen by Suter during his revision of Hutton's types, but it has since been found. It is a closed individual with much of the sculpture worn away, but with the crenulated margin showing clearly. Thus the shell is nearer to *Chione* as first classed by Hutton than to *Macrocallista* as he afterwards supposed. The other shells to which he applied the name *Cytherea assimilis* (= the *Macrocallista assimilis* of Suter) were only flattened forms of *Paradione multistriata* (Sowerby). Hutton gave the locality as Wanganui, thereby including a large district, so the exact horizon is not known. In the large collections examined from this district no duplicate of the type has been found.

Tawera wanganuiensis n. sp. (Figs. 141-3).

Shell rather small, trigonally oval. Lunule lanceolate bounded by incised line; escutcheon superficial, scarcely defined. Sculpture of

close, bevelled concentric ridges about ·75 mm. apart, these ridges become obsolete on posterior part of shell which is almost smooth. Cardinal teeth widey divergent, embracing angle of 105°; left hinge with long high posterior cardinal welded to nymph; narrow equally-divided median; and long, narrowly-triangular obscurely-grooved anterior one. Right hinge with short, somewhat narrow, grooved posterior cardinal; long, triangular, grooved median; and low entire anterior one. Pallial sinus short, narrow, ascending, end irregularly truncated. Pedal retractor separated from adductor. Valve-margins finely, regularly crenate.

Type in collection of N.Z. Geological Survey.

Height 19·5 mm., length 23·5 mm., thickness (one valve) 6 mm.

Localities: Castlecliff, common (type); Landguard Bluff, rare.

The smooth posterior area makes this Castlecliff relative of *T. spissa* easily recognizable. A few specimens show the sculpture persisting, but no exact collecting has yet been done to show whether this has a stratigraphical explanation. The strength of the concentric ribs and the degree of inflation have a considerable range of variation resembling the Recent *spissa-mesodesma* combination. The writer was at first inclined to identify these shells with *T. assimilis*, but as no individual agreeing closely with the type was found in the hundreds of Castlecliff specimens available, it was finally decided to keep them apart.

Tawera spissa (Deshayes). (Figs. 144-8.)

1835 *Venus spissa* Deshayes *Anim. s. Vert.* ed. 2, vol. 6, p. 373.
1835 *Venus crassa* Quoy and Gaimard, *Voy. Astrol.* 3, p. 525, pl. 84, f. 7, 8.
1835 *Venus mesodesma* Quoy and Gaimard, *Voy. Astrol.* 3, p. 532, pl. 84, f. 17, 18.
1873 *Chione gibbosa* Hutton, *Cat. Mar. Moll.* p. 71.
1915 *Chione spissa* (Deshayes) Iredale, *Trans. N.Z. Inst.*, vol. 47, p. 495.

For further synonymy see Suter's *Manual,* p. 991.

Iredale and Smith are in favour of uniting *C. spissa* and *mesodesma* and the series examined during the present revision rather favours this proceeding. The writer must confess that he is uncertain on the point, but certainly finds it hard to decide on the classification of many of the specimens, both recent and fossil.

Localities: Recent, type; Landguard Bluff; Motunau; Okehu; ? Waipipi; ? Tarata (Lower Waitotaran), fragments.

(?) *Tawera carri* n. sp. (Figs. 164-5).

Shell large, heavy, inflated, oval; beaks prominent, well forward. Lunule large, bounded by incised line; escutcheon broad, well depressed. Sculpture consisting of broad, rounded, concentric ribs, sometimes divaricating, interstices of about the same width as the ribs. Hinge not seen. Margins crenulated.

Type in collection of N.Z. Geological Survey.

Height (estimated) 50 mm., length (estimated) 60 mm., thickness (one valve) 22 mm.

Localities: Neilson's Quarry, Whangamomona Road, half a mile N. of Tahunaroa Road, Mahoe S.D., Taranaki (type); S.W. end Pohokura Tunnel, Stratford-Whangamomona Railway.

Remarks: The sculpture of this shell is quite different from that of any other of our Venerids, and it is probable that a new division is required.

6. Genus Bassina Jukes-Browne, 1914.

Type: *V. pachyphylla* Jonas (= *V. paucilamellata* Dunk.).

Jukes-Browne considered the New Zealand *V. yatei* Gray as sectionally separable from *Bassina pachyphylla* but did not indicate any important differences between the two shells. *V. yatei* was classed by him in a new subgenus of *Venus*, *Salacia*, type *V. disjecta* Perry (= *V. lamellata* Lamk.), but this was shown by Iredale (1917, p. 329) to be preoccupied. In its stead Iredale proposed *Callanaitis* with *V. yatei* as type. The differences between *V. yatei* and *V. pachyphylla* are of degree, not of kind. The hinge-teeth exactly correspond, having the same huge, unequally-divided, left median cardinal, and narrow right cardinals; the pallial sinus has the same peculiar linguiform descending attitude; and the lunules of both are long, lanceolate, concave, with a central depressed area, the right side encroaching on the left. *V. pachyphylla* differs from *V. yatei* in its more trigonal shape, greater inflation, weaker escutcheon, and slight development of the concentric lamellae. On many specimens of *V. yatei* the lamellae are practically absent from the central part of the disc, so their extent does not seem to possess generic or subgeneric significance.

Key to Species.

Under 20 mm. high	*B. parva*
Over 20 mm. high	
One ridge running from umbo to posterior	*B. yatei*
Two ridges running from umbo to posterior	*B. speighti*

Bassina yatei (Gray) (Figs. 161-3).

For synonymy see Suter's *Manual*, p. 990, to which add 1917, *Chione chiloensis* (Philippi) var. *truncata* Suter, *N.Z. Geol. Surv. Pal. Bull.* 5, p. 75, pl. 13, fig. 5.

Suter's type of *C. truncata* is a decorticated shell and what he took for radial sculpture is but the tubular structure of an internal shell layer which is revealed by weathering on shells with a crenulated margin.

Localities: Recent, type; Castlecliff; Nukumaru; Maraekakaho; 1135, Tirangi Stream, North Taranaki; Awamoa; Target Gully.

The shells from Nukumaru are very large and elongate, those from Awamoa rather short, but as the Recent specimens differ among themselves considerably in shape, all have been considered here as one species.

Bassina speighti (Suter) (Figs. 156-7).

1913 *Chione (Lirophora) speighti* Suter, *Trans. N.Z. Inst.*, vol. 45, p. 296, pl. 14, figs. 1 and 2.

The sculpture of *Lirophora* consists of thick, rounded, concentric ridges which become lamellate posteriorly and so is quite different from the thin concentric, recurved laminae of *Bassina.*

Type in the Canterbury Museum.

Height 54 mm., length 61 mm., thickness (one valve) 12 mm.

Localities: Lower Gorge of Waipara (lower horizon); 908 Tongaporutu Road, three miles S.W. of Ohura (Henderson and Ongley, 1923, p. 23); 1065, Kururau Road, three miles W. of Taumarunui; 1022, Waterfall, Mangapapa Stream, Tangarakau River; Chatton Creek (fragment).

Bassina parva n. sp. (Figs. 153, 155).

Shell small, suboval, ventral margin with shallow sinus posteriorly. Lunule concave, strongly striated with central deeply depressed almost vertical area; escutcheon smooth, narrow in right valve, well marked in left. Sculpture of distant raised laminae, with reflexed and irregular edges, interstices weakly concentrically striated, two ridges run from umbo towards posterior and bound each side of ventral sinus, they are marked by a noticeable kink in the laminae. Hinge dipping steeply forward; right valve with very narrow, grooved posterior cardinal; bevelled, triangular, weakly-grooved median and lamellar anterior one parallel to lunule, and to front face of median tooth. Left valve with long, vertical, narrow anterior cardinal; stout grooved median; and lamellar posterior cardinal welded to nymph. Pallial sinus horizontal linguiform, reaching about the middle of the shell. Valve-margins finely crenate.

Type in collection of N.Z. Geological Survey.

Height 17 mm., length 21 mm., thickness (one valve) 5·5 mm.

Localities: 1089 Okauawa Creek, Ngaruroro River; 184 Porangahau Creek, Ruataniwha Plains, Hawkes Bay.

7. Genus CLAUSINELLA Gray, 1851.

Type: *Venus fasciata* Da Costa.

Clausinella morgani (Marwick) (Figs. 152, 154).

1924 *Chione morgani* Marwick, *Proc. Aust. Ass. Adv. Sc.*, vol. 16, p. 323, pl. 6, fig. 7.

Only two left valves have as yet been collected, but they suffice to show the essential characters of the species. The lunule is concave, deeply impressed, and bounded by an incised line. Sculpture of spaced, recurved, very strong concentric ridges. Hinge strongly bent, left valve with posterior cardinal joined to nymph, but defined above by narrow groove; anterior cardinal long, joined above to median which is broadly triangular, strongly bevelled and unequally grooved. Valve-margins finely, regularly crenate.

Holotype in collection of N.Z. Geological Survey.

Height 13·5 mm., length 16 mm., thickness (one valve) 4·5 mm.

Localities: 243, Fan Coral Bed, Trelissick Basin (= *Chione subroborata* Tate, Suter, 1921, p. 29): Tuffs between upper and lower

limestone, Trelissick Basin (= *Chione yatei* (Gray) juv., Suter, 1921, p. 51).

8. Genus Chione, Megerle 1811.

Type: *Venus cancellata* Linné.

a. Subgenus **Austrovenus** Finlay, 1927.

Type: *Venus stutchburyi* Gray.

Shell fairly large, oval. Lunule large, not impressed, radially ribbed, bounded by shallow depression not by incised line; escutcheon defined by absence of radials, shallow on flat specimens but fairly deep on thick inflated ones. Sculpture of rounded radial ribs, with narower interstices crossed by low, well-spaced, irregular, concentric lamellae which often die out on posterior half of shell, posterior area marked by obsolescence of radials. Hinge-teeth all divergent; left valve with long, high, curved, posterior cardinal welded to nymph; broadly-triangular, slightly-curved, grooved median; and strong, triangular, often obscurely-grooved, anterior one. Right valve with long, somewhat narrow, curved, grooved posterior cardinal; short, broadly-triangular, grooved median, and narrow lamellar anterior one. Pallial sinus short, ascending. Pedal retractor close to and often joining adductor. Valve-margins bicrenate.

Austrovenus is closely related to *Chione* s. str. as shown by the close agreement of the hinge, pallial sinus, marginal crenation and sculpture. The Recent *C. stutchburyi* differs principally from *C. cancellata* in lacking the well-defined concave escutcheon which imparts a triangular shape, and in the concentric lamellae being less persistent and lower. The Californian *Chione fluctifraga* Sowerby also is without a concave escutcheon and so agrees closely with *A. stutchburyi* in shape and general characters. The sculpture, however, differs, for the concentric ribs are flattened out and have smooth surfaces. Fossil ancestors of *C. stutchburyi* from the Pliocene have an escutcheon almost as well defined as that of *C. cancellata*. *Chione* seems to be regarded by some authors as preoccupied by the prior *Chion*, but as one is the name of a goddess and the other that of a man this course does not seem justified. The words themselves are not synonymous.

Chione (Austrovenus) stutchburyi (Gray). (Figs. 158-60.)

1927 *Austrovenus stutchburyi* (Gray): Finlay (this volume).

For synonymy see *Chione stutchburyi* Suter's *Manual*, p. 987.

Suter said that the escutcheon "is wanting," but this is not correct. It is marked by the absence of radial ribs and in large, heavy individuals it is quite deeply sunken.

Localities: Recent (type): 1102, Waipaoa beds, Awatere River, East Cape; Castlecliff; Kai-iwi; Okehu; Nukumaru; Maraekakaho.

Chione (Austrovenus) crassitesta Finlay (Figs. 172, 173).

1924 *Chione crassitesta* Finlay, *Trans N.Z. Inst.*, vol. 55, p. 478, pl. 50, figs. 1a, b, c.

Although *A. stutchburyi* varies enormously according to station, and some recent forms are much inflated and have a deep escutcheon,

yet the typical *A. crassitesta* can easily be distinguished by its triangular outline, thicker and more persistent concentric ridges, and deeper escutcheon. Small varieties of *crassitesta*, common at Kereru and Wharekahika can be distinguished by their well-defined escutcheon. Nevertheless it is difficult if not impossible to draw a sharp line of distinction between the two species. *C. crassitesta* is an important species to the stratigrapher, for it seems to be characteristic only of the Nukumaruan Stage.

Localities: Clifden, Hawkes Bay (type); Nukumaru; 188, Kereru (small form); 190, Shrimptons, Ngaruroro River (small form); 1121, Wharekahika River, one mile below Oweka junction, East Cape (small); Greta Beds, Kowai River, Waipara (small).

b. Subgenus **Hinemoana**

(from Maori, the Ocean Maid, or Goddess of the Ocean.)

Type: *Chione acuminata* Hutton.

Shell somewhat small, ovate-trigonal. Lunule slightly impressed, with bulging central area, bounded by weakly-incised line; escutcheon narrow, rounded and not well defined in right valve, broader and flattened in left valve with well-marked bounding ridge. Sculpture of extremely fine crowded concentric lamellae six to eight per mm. on adult, slightly more spaced on juvenile; fine dense radials are often faintly indicated by waving of the concentrics. Hinge-teeth all short. Left valve with posterior cardinal thick and welded to nymph; median cardinal thick, grooved; anterior one sometimes lightly grooved. Right valve with rather short, moderately thick, grooved posterior cardinal; very stout grooved median, and narrow anterior one. Valve-margin of right valve at end of escutcheon very deeply grooved to receive edge of left valve, inner side of groove thickened and raised into a posterior lateral tooth. Pallial sinus very short, angular. Pedal retractor sometimes joined to, sometimes separated from anterior adductor. Valve-margins somewhat irregular crenate.

The cardinal teeth are practically the same as those of *Austrovenus* and *Chione*, but the sculpture is different, also there is a decided posterior lateral tooth below the marginal groove in the right valve. It seems, therefore, unlikely that *Austrovenus* is directly descended from this subgenus for *C. stutchburyi* shows as much if not more resemblance to the American species of *Chione* s. str.

Chione (Hinemoana) acuminata (Hutton). (Figs. 168, 170, 171.)

1873 *Chione accuminata* Hutton, *Cat. Tert. Moll.*, p. 21.

1914 *Chione acuminata* Hutton (em.): Suter, *N.Z. Geol. Surv. Pal. Bull, No. 2*, p. 51, pl. 14, fig. 3.

Some specimens show no trace of the fine radial ribbing except on weathering.

Locality: Pomahaka, Otago.

The age of the Pomahaka beds is uncertain. They contain a brackish-water fauna which consists of extinct species not known from any other locality, and so are of considerable antiquity, perhaps Oligocene.

(4) Subfamily TAPETINAE.

Key to Genera and Subgenera.

(1) Margins crenate, pallial sinus acute.	
A. Longitudinally attenuated, anterior very narrow, sharp concentric lamellae predominating	***Notopaphia***
B. Oval-oblong, broad radial ribs predominating.	***Tuangia***
(2) Margins smooth, pallial sinus ample.	
A. Shell very small, subtrigonal, beaks almost central	***Gomphinella***
B. Shell moderate to large size, oval.	
1. Surface smooth	***Eumarcia***
2. Well spaced concentric grooves, interspaces polished, sometimes raised.	***Atamarcia***
C. Shell small to moderate size, oblong.	
1. Sharp, erect, close concentric ridges	***Callistotapes***
2. Close, branching, concentric cords crossed by fine, radial, waved grooves.	***Paphirus***
3. Sharp, spaced, concentric lamellae	***Irona***
D. Shell large, subcircular, sculpture of extremely fine regular concentric threads	***Cyclorismina***

1. Genus Notopaphia, Oliver, 1923.

Type: *Venerupis elegans* Deshayes.

Shell rather small, oblong, anterior produced to narrow point. Lunule not impressed, bounded by deeply incised line; escutcheon narrow but well defined. Sculpture of sharp, spaced concentric lamellae, interspaces with numerous fairly strong radial threads which are rendered rugose by concentric growth-lines. Teeth high, but short, not reaching lunular margin; left hinge with posterior cardinal joined to nymph; median rather narrow, grooved, curved; anterior longer, about same width, shallowly-grooved and curving strongly forward. Right hinge with broadly-triangular, deeply-divided, posterior cardinal; median about same strength, also equally divided; anterior cardinal entire, almost parallel to lunular margin. Pallial sinus moderate, triangular slightly ascending. Pedal retractor joined to adductor. Valve-margins crenate.

Notopaphia elegans was considered to be a typical *Venerupis* by Jukes-Browne, but the teeth are much more divergent, the angle embraced by those of the right valve being about 135° while the teeth of *V. irus* cover only 105°. Also the lunule is bounded by a deeply-incised line, the valve-margins are crenate and the pallial sinus is angular.

Notopaphia elegans (Deshayes). (Figs. 174, 176, 177.)

1854 *Venerupis elegans* Desh., *Proc. Zool. Soc.* (1853) p. 5, pl. 18, fig. 2.

1923 *Notopaphia elegans* (Desh.): Oliver, *Proc. Malac. Soc.*, vol. 15, p. 185, text fig.

For further synonymy see Suter's *Manual*, p. 997.

Locality: 689, Raised Beach, Mahia Peninsula (Pleistocene).

2. Genus Protothaca Dall, 1902.

Type: *Chama thaca* Molina (= *V. dombeyi* Lamarck).

Shell of moderate size, oval, dorsal margin high, angled at junction with posterior margin. Lunule not impressed, bounded by in-

cised line; escutcheon defined only in left valve. Sculpture: surface divided into three zones; anterior one with radials, stronger in front, crossed by low, wide, bevelled, concentric ribs; middle zone with radials only, the ribs of different widths, low and bevelled; posterior zone with strong, radials separated by deep linear interspaces and crossed by rough, somewhat irregular concentric ridges. Teeth all moderately strong, left median and right posterior and median grooved; nymphs narrow, sunken; resiliary surface short, posterior end not raised out of ligamental groove, anterior end broad, thus forcing posterior cardinals downwards. Pallial sinus of moderate depth, linguiform, slightly ascending. Pedal retractor separated from adductor. Valve-margins crenate.

a. Subgenus **Tuangia** n. subgen. (Tuangi—Maori name for type species).

Type: *Venus crassicosta* Deshayes.

Shell of moderate size and inflation, strong, oval, dorsal margin joining posterior margin in gradual curve. Lunule superficial, bounded by incised line, no escutcheon. Surface divided into three zones as in *Protothaca,* but radial ribs much broader; anterior zone with radials separated by linear interstices and crossed by bevelled concentrics; middle zone with bevelled radials only; radials higher and interstices wider than on rest of shell, concentrically irregularly roughened. Teeth as in *Protothaca;* nymphs narrow but not sunken; resiliary surface long, posterior end raised, anterior end broad, thus forcing posterior cardinals downwards. Pallial sinus rather short, acute, slightly ascending. Pedal retractor separated from adductor. Valve margins crenate.

Protothaca crassicosta differs from *Protothaca thaca* in shape, in the disposition of the nymphs, in the coarse sculpture and in the smaller pallial sinus. Nevertheless the sculpture is formed on the same principle, and the hinge-teeth are practically the same, so the two shells must be closely related. The points of agreement are too many to be considered the result of convergence.

The Californian species *P. grata* Say and *P. staminea* Conrad have nymphs with a raised posterior end similar to those of *P. crassicosta,* also *P. grata* has a short acute pallial sinus. In shape these two species are intermediate between *P. thaca* and *P. crassicosta,* but they have fine sculpture and so are probably more closely related to *Protothaca* s. str.

Protothaca (Tuangia) crassicosta (Deshayes). (Figs. 178, 181-2.)

1835 *Venus crassicosta* Desh., *Anim. s. Vert.,* ed. 2, vol. 6, p. 373.
1913 *Paphia (Protothaca) costata* (Q. & G.): Suter, *Man. N.Z. Moll.,* p. 996, pl. 61, fig. 7.
1915 *Protothaca crassicosta* Desh.: Iredale, *Trans. N.Z. Inst.,* vol. 47, p. 496.

For further synonymy see Suter's *Manual,* p. 996.

Localities: Recent (type); 689, Raised Beach, Mahia Peninsula (Pleistocene).

3. Genus Cyclorismina n. gen.

Type: *Cyclorismina woodsi* Marwick.

Shell large, oval to subcircular, thin. Lunule deeply impressed, concave, well defined but with no bounding line; no escutcheon. Sculpture of fine regular concentric grooves, separated by low rounded ridges two to three per mm. Hinge with three cardinals in each valve, no anterior lateral; right valve with broad, curved, deeply-grooved, posterior cardinal; median entire, slightly stronger than anterior cardinal which is also entire and divergent. Left valve with long posterior cardinal separated from nymph by shallow groove; moderately broad, probably grooved median cardinal joined above to narrowly-triangular anterior cardinal, immediately in front of which and parallel to it is narrow, rather deep groove for reception of right anterior cardinal; anterior margin of this groove raised into low ridge. Surface of ligamental attachment broad, almost vertical. Pallial sinus deep, linguiform, directed at top of anterior adductor. Valve-margins smooth.

This shell was classed by Woods (1917, p. 32) as a *Dosinia* and was compared with other Cretaceous species supposed to belong to that genus. The resistant matrix has now been cleared from the hinges of several specimens, revealing the absence of an anterior lateral tooth.

The shells classed in *Cyclorisma* Dall, which Dall and Jukes-Browne both considered a subgenus of *Cyprimeria* Conrad may be related to *Cyclorismina.* They agree in general shape and sculpture and in the number though not the disposition of the teeth. In both *Cyprimeria* and *Cyclorisma* the two front cardinals of the right valve are almost parallel and are directed strongly forward, the median being continued along the hinge-margin. In *Cyclorismina* the two anterior cardinals are divergent and a continuation of either would intersect the hinge-margin at a high angle. *Cyprimeria* has practically no pallial sinus, *Cyclorisma* has a moderate one, but *Cyclorismina* has quite a deep sinus directed at the anterior adductor and reaching past the centre of the disc. In addition, the lunule of *Cyclorismina* is deeply impressed while that of *Cyprimeria* (also *Cyclorisma)* is superficial.

A noticeable character of *Cyclorismina woodsi* is the *Dosinia*-like, almost vertical resiliary surface. A similar surface seems to be possessed by Stoliczkai's *Cyprimeria oldhami,* but the writer had not had access to any figures of *C. carolinensis* Conrad, the type of *Cyclorisma.* Jukes-Browne's description of the hinge of *Cyclorisma* does not agree with Dall's, but it was compiled from European and Indian shells, not from the type. It seems quite possible that *C. oldhamia* is not a *Cyclorisma,* for according to Stoliczkai's figure the anterior teeth do not run parallel to the hinge-margin but intersect it as do those of *Cyclorismina.*

Cyclorismina woodsi n. sp. (Figs. 185-7.)

1917 *Dosinia* sp. Woods. *N.Z. Geol. Surv. Pal. Bull., No. 4,* p. 32, pl. 18, fig. 1.

For description see generic diagnosis above.

Holotype in collection of N.Z Geological Survey.
Height 47 mm., length 55 mm., thickness (one valve) 13 mm.
Locality: 589, Selwyn Rapids (Upper Senonian).

4. Genus Eumarcia Iredale, 1925.

Type: *Venus fumigata* Sowerby (= *nitida* Q. & G.).

a. Subgenus **Eumarcia** s. str.

Shell triangularly oval. Lunule not impressed, bounded by weak line; escutcheon not defined. Surface smooth and polished. Left valve with narrow posterior cardinal joined to nymph without separating groove; median and anterior cardinals of about equal strength, triangular, deeply grooved. Right valve with moderate, triangular, grooved, posterior cardinal; very narrow, grooved median and entire anterior one. Pallial sinus wide; not very long, ascending. Pedal retractor separated from anterior adductor. Valve-margins smooth.

The type, a Recent eastern Australian shell, is small and thin, but in no other way does it differ from the large heavy smooth shells from the Upper Tertiary of New Zealand. Suter generally identified these shells as *Paphia curta* irrespective of sculpture, but *Eumarcia* is easily distinguished from *Paphia* by its subtrigonal shape, divergent teeth, and shorter ligament.

b. Subgenus **Atamarcia** n. subgen.

Type: *Eumarcia sulcifera* Marwick.

Shell large, thick. Lunule impressed, but central area arched over anterior cardinals, bounded at first by obsolete line, later this disappears, its place sometimes taken by low ridge; escutcheon deep, wider in left valve. Sculpture of close, fairly regular concentric grooves with smooth polished interspaces; grooves closer on posterior area and deeper on anterior portion of disc. Left valve with fairly long posterior cardinal along upper side of which nymph is raised nearly to same level, boundary between the two shown by slight groove; median cardinal moderately strong, deeply and evenly divided; anterior cardinal triangular, much higher than and almost as strong as median, occasionally with slight groove on upper edge. Right valve with broad, curved, grooved posterior cardinal; narrow grooved median and entire lamellar anterior one. Pallial sinus linguiform, horizontal, generally reaching about half-way across. Pedal retractor separated from adductor. Valve margins smooth.

Atamarcia differs from *Eumarcia* in its grooved surface, its slightly or not at all grooved left anterior cardinal, its stronger, more curved right posterior cardinal, deep escutcheon and impressed lunule. In several species e.g., *E. crassa* the concentric sculpture is not strongly marked so that the surface approaches that of *Eumarcia* but the lunule, escutcheon and teeth show that the relationship is to *Atamarcia*.

In hinge characters *Hemitapes* Roemer, type *V. rimularis* Lamarck strongly resembles *Atamarcia* but its sculpture although predominatingly concentric is of a very different kind. The concentric grooves of *Atamarcia* are straight, the interspaces smooth and polished and there is no trace of radial ornament. The grooves of *Hemitapes* are

waved and the interspaces are wrinkled by fine radials. Further, the left median cardinal of *Hemitapes* is rugose and unequally divided in a most peculiar manner, the narrow groove swinging off to the right above, so that all the upper end of the tooth where it joins the lunular margin is a continuation of the posterior flange. The smooth left median cardinal of *Atamarcia* is rather deeply and broadly divided along its full length into two equal ridges.

Key to Species.

(1) (*Eumarcia*) Surface smooth, no concentric grooves, lunule and escutcheon superficial.	
A. Outline triangular, beaks subcentral in adult	*pareoraensis*
B. Outline broadly oval, beaks fairly prominent	*kaawaensis*
C. Outline longitudinally oval, beaks low	
1. Lunule not pouting	*plana*
2. Lunule pouting strongly	*altilunula*
(2) (*Atamarcia*) Concentric grooves generally strong, sometimes obsolete centrally, lunule and escutcheon well impressed.	
A. Grooves marked only on extremities, obsolete centrally.	
1. Shell very large (100 mm.) heavy, inflated	*enysi*
2. Shell of moderate size (50-60 mm.).	
a. Extremely thick	*crassa*
b. Dorsal margin strongly humped	*thomsoni*
B. Grooves fairly strong distally, somewhat weaker centrally.	
1. Beaks about anterior third.	
a. Sculpture coarse, hinge broad, beaks low	*curta*
b. Sculpture fine, hinge narrow, beaks high	*sulcifera*
2. Beaks about anterior fourth, sculpture coarse	*crassatelliformis.*
C. Groves separating high ridges which persist across disc	*benhami*

Eumarcia pareoraensis (Suter). (Figs. 175, 179, 180, 183.)

1917 *Macrocallista pareoraensis* Suter, *N.Z. Geol. Surv. Pal. Bull.* No. 5, p. 74, pl. 8, fig. 5.

Shell of moderate size, thin, subtrigonal; beaks wide, prominent. Lunule long, lanceolate, slightly impressed, bounded by obsolete line; escutcheon inconspicuous. Surface smooth and shining, young shell with weak concentric grooves distally. Hinge narrow, right valve with moderate, straight, triangular grooved cardinal; very narrow grooved median; and lamellar anterior cardinal. Left valve with posterior cardinal separated from nymph by shallow groove; median cardinal very broad and grooved; anterior narrowly triangular, shallowly grooved. Pallial sinus moderate, somewhat ascending, rounded in front. Pedal retractor separated from adductor. Valve-margins smooth.

Dimensions of adult: height 41 mm., length 54 mm., thickness (one valve) 13 mm.

Localities: 458, Lower Gorge, Pareora (Suter's holotype and two paratypes); also large smooth specimen identified by him as *Paphia curta*, 25 ft. below conglomerate, Mead Gorge, Marlborough (J. A. Thomson); 165 White Rock River.

Suter's holotype is a small decorticated, closed individual with the original shining outer layer adhering only to the lunule and part of

the dorsal margin. The rest of the disc consists of an inner layer which is regularly-concentrically grooved and does not represent the true surface. In outline the holotype differs much from the larger specimens, having a long, high, dorsal margin and a truncated posterior. Faint growth-lines on the large shells, however, show that they possessed a similar outline when young.

Suter did not explore the hinge or he would have seen that the shell is not related to *Macrocallista,* having no anterior tooth. The matrix of the types is very hard, but the hinge-lines of the two paratypes, both left valve, have now been cleared so as to reveal the essential features.

The large specimen from 165, White Rock River seems to have been more attenuated than that from locality 458, the anterior dorsal margin being much higher.

Eumarcia kaawaensis n. sp. (Figs. 211, 212.)

Shell fairly large, rather fragile, broadly oval, well inflated. Lunule lanceolate, slightly concave; no escutcheon. Surface smooth and polished. Hinge narrow, right valve with narrowly triangular, straight, grooved, posterior cardinal; narrow, grooved, median and narrow entire anterior one; ligamental area of nymph with raised, slightly rugose lower margin. Pedal retractor separated from adductor. Valve-margins smooth.

Type in collection of N.Z. Geological Survey.

Height (estimated) 52 mm., length (est.) 61 mm., thickness (one valve) 18 mm.

Locality: 996, Kaawa Creek (J. Henderson) (= *Paphia curta* of Bartrum, 1919, p. 105).

Easily separated from *E. plana* by greater height and inflation.

Eumarcia plana n. sp. (Figs. 207, 210.)

Shell large, longitudinally oval rather flat. Lunule very large, lanceolate, superficial, bounded by an obsolete line; no escutcheon. Surface smooth and polished with broad obscure concentric waves. Left valve with straight, long, strong, posterior cardinal joined to nymph without groove; fairly strong, deeply and widely-grooved median cardinal; and fairly strong weakly-grooved anterior one. Right valve with almost straight, moderately strong, grooved, posterior cardinal; narrowly triangular, slightly grooved, median; and strong, entire, posterior cardinal, parallel to lunule. Pedal retractor far in front of anterior cardinal but well separated from adductor. Valve-margins smooth.

Type in collection of N.Z. Geological Survey.

Height, 60 mm., length 83 mm., thickness (one valve) 19 mm.

Localities: Waipipi Beach, Waverley; Boat-landing, Nukumaru, type (= *Cytherea enysi of Marshall and Murdoch, 1920, p.* 124).

Eumarcia altilunula n. sp. (Fig. 196.)

Shell large, oval, thin, little inflated, beaks at anterior third, not very high. Lunule not impressed nor marked off by bounding line, the inner margin very high; escutcheon broad and shallow in the left valve, bounded by a broad low ridge, surface smooth with obsolete

concentric lines which are more noticeable on the posterior area, hinge obscured.

Holotype in the collection of Mr. H. J. Finlay.

Height 66 mm., length 87 mm., thickness (one valve) 18 mm.

Locality 7c, Clifden, Southland.

Remarks: This species is distinguished from all the others by the lunule not being impressed and by its high inner margin. The outline is somewhat similar to that of *E. plana,* but the anterior is better developed.

Eumarcia (Atamarcia) crassa n. sp. (Figs. 202, 216, 217.)

Shell fairly large, extremely thick and solid. Lunule broadly lanceolate, deeply impressed, concave, bounded by a ridge, arched up over anterior teeth; escutcheon fairly deep. Sculpture of low, flat, concentric ridges which die out on centre of disc leaving it obsoletely plicate, shining and almost smooth, ridges stronger distally. Hinge-plate very broad and solid, teeth long and strong; left valve with apparently very thick, long, grooved, posterior cardinal; grooved median, and entire anterior ones. Right valve with strong, curved and grooved posterior cardinal; median somewhat narrower, probably grooved; anterior small, entire; nymphs strong high. Muscular impressions deeply sunk. Pedal retractor well separated from adductor. Valve-margins smooth.

Syntypes in collection of N.Z. Geological Survey.

Dimensions (estimated): height 58 mm., length 68 mm., thickness (one valve) 21 mm.

Localities: 1029, 90 chains N.W. of Trig. B., Alexandra Survey District, Kawhia; Greensand at base of Tertiary, boundary blocks 10 and 11, Awaroa Surv. Dist., Huntly; ? Hikurangi Coal Mine, presented by Mr. Taylor, Mine Manager. These last specimens do not show hinges so their identity is uncertain.

Eumarcia (Atamarcia) crassatelliformis n. sp. (Figs. 191, 192.)

Shell of moderate size, inequilaterally subtrigonal, beaks at anterior fourth, broad and prominent, but not raised much above top of hinge; anterior margin short, posterior produced, narrowly concave, bounded by incised line; escutcheon not impressed. Sculpture of waved concentric shallow grooves with broad, flat interspaces. Hinge with three well-spaced cardinals, the left median grooved. Valve-margins smooth.

Holotype in collection of Mr. H. J. Finlay.

Height 40 mm., length 53 mm., thickness (one valve) 13 mm.

Locality: Mussel Beach, Te Wae Wae Bay, Southland.

Eumarcia (Atamarcia) curta (Hutton). (Figs. 199, 201, 204, 206.)

1873 *Tapes curta* Hutton, *Cat. Tert. Moll.,* p. 22.

1886 *Tapes curta* Hector, *Outline Geol. N.Z.* p. 54, fig. 2, no. 15.

1887 *Tapes curta* Hutton, *Proc. Linn. Soc., N.S.W.* (2), vol. 1, p. 227.

1914 *Paphia (Ruditapes) curta* (Hutton) Suter, *N.Z. Geol. Surv. Pal. Bull.* no. 2, p. 52, pl. 14, f. 6.

Further specimens have enabled more features to be distinguished than are mentioned in Suter's description. Lunule well impressed,

concave, marked off by line above and ridge below, central part only slightly bulging over anterior teeth; escutcheon unequally divided, of moderate depth, smooth, very narrow in the right, much wider in the left. Hinge-plate deep and teeth strong; distance across hinge greater than from top of shell to hinge. Right valve with posterior cardinal strong, curved and grooved, median and anterior cardinals long, narrow and entire (median faintly grooved in some cases). Left valve with posterior cardinal long and strong, rugose, welded to nymph without groove; median very strong, deeply bifid; anterior only of moderate width, entire; nymphs strong and deep.

The sculpture is fairly strong, consisting of concentric grooves with flat polished interspaces. The grooves are close together and strong on the anterior and posterior regions, but are further apart and shallower on the central portion of the disc. The "radial striae" mentioned by Suter are merely accidents of weathering. Buchanan's drawing, published by Suter, does not correctly interpret the sculpture, the grooves being much further apart in the centre of the disc than is represented.

Localities: 237, Broken River = shell bed at base of Pareora Beds, junction of Porter and Thomas rivers (J. A .Thomson); shell bed Target Gully, smaller than type, may be another species

Suter was very fond of using this specific determination, applying it to nearly all the moderate-sized shells of the genus, irrespective of sculpture, shape, or details of the hinge. His records are, therefore, unreliable.

Eumarcia (Atamarcia) sulcifera n. sp. (Figs. 200, 203, 205.)

For description see diagnosis of *Atamarcia* p. .

Type in collection of Mr. H. J. Finlay.

Height 54 mm., length 88 m., thickness (one valve) 17 mm.

Locality: Target Gully Shell Bed, Oamaru.

Distinguished from *E. curta* by having finer, more regular sculpture (one or two grooves per mm.) narrower hinge, and higher beaks. The distance across the hinge of *E. sulcifera* is equal to the distance from the top of the hinge to the summit of the shell. In *E. curta* the distance across the hinge is greater.

Eumarcia (Atamarcia) enysi (Hutton). (Fig. 193.)

1873 *Cytherea enysi* Hutton, *Cat. Tert. Moll.* p. 21.

1886 *Cytherea enysi* Hector, *Outline Geol. N.Z.* p. 51, fig. 9, no. 10.

1887 *Cytherea enysi* Hutton, *Proc. Linn. Soc., N.S.W.* (2), vol. 1, p. 226.

1914 *Cytherea enysi* Hutton, Suter, *N.Z. Geol. Surv. Pal. Bull.* No. 2, p. 5, pl. 14, fig. 2.

Shell very large, solid, beaks large and prominent; posterior dorsal margin broadly curved, descending regularly to the posterior extremity which is sub-angular; anterior margin regularly rounded, concave under the umbones. Lunule large, almost smooth, deeply excavated, concave, upper part marked off by shallow line, but below bounded by ridge caused by its own concavity; escutcheon very narrow, moderately deep in right valve, probably wider in left. Sculpture:

extremities with irregular, shallow, concentric grooves separating wide flat interspaces which become narrower and slightly more raised distally, greater part of the disc almost smooth. Hinge-plate strong and deep; right valve with posterior and median cardinals shallowly grooved; anterior almost parallel to lunular margin which it causes to bulge. Left valve with median cardinal grooved; nymphs enormous, dorsal edge horizontal, raised to level of dorsal margin of shell, right nymph with raised rugosity parallel to posterior cardinal. Pallial sinus linguiform, horizontal. Valve margins rounded, smooth within.

Type in collection of N.Z. Geological Survey.

Height 95 mm., length 110 mm., thickness (one valve) 28 mm.

Localities: Lower Waipara Gorge; Broken River, Trelissick Basin; Porter River, Trelissick Basin.

Remarks: Hutton noticed the smooth margins but did not have a specimen showing the hinge, hence his classification of the species under *Cytherea* Lamarck = *Meretrix* Lamarck. Suter's use of *Cytherea,* however, is in quite a different generic sense, being that of Bolten. Both of these genera have an anterior lateral tooth and the latter has in addition a crenulated margin, so that neither can be applied to this species.

Eumarcia (Atamarcia) thomsoni n. sp. (Figs. 194, 197).

Shell fairly large, solid, outline trapezoidal; beaks very large, curved forward, at anterior fourth, posterior dorsal margin descending strongly, bent in middle, with a humped appearance; posterior end narrowly convex; ventral margin broadly regularly rounded, anterior margin concave below the umbones then straightened and descending; anterior end narrowly convex. Lunule lanceolate, impressed, concave, bounded by line above and ridge below; escutcheon narrow in right valve, fairly broad and bounded by low ridge in left. Nymphs visible dorsally, apparently wide and strong. Sculpture consisting of concentric narrow grooves, closer together on the anterior and posterior portions, interspaces wide, smooth and shining. Valve-margins smooth.

Holotype, a closed individual in the collection of N.Z. Geological Survey.

Height 52 mm., length 62.5 mm., thickness (one valve) 16.5 mm.

Locality 749, Hurupi Creek, N.E. corner Palliser Bay; (also collected by J. A. Thomson).

Note. The collection from locality 749 was stated by McKay (see *N.Z. Geol. Surv. Pal. Bull.* 1, p. 92) as from "Cliffs at mouth of Ruamahanga River." Part of the collection is from this spot, but part also, including this species, from further along the coast at Hurupi Creek, a much lower horizon.

The details of the sculpture are beautifully preserved in the specimen collected by Dr. Thomson, but unfortunately the extremities are broken off.

Eumarcia (Atamarcia) benhami nom. mut. (Fig. 195.)

1875 *Venus (?) sulcata* Hutton, *Trans. N.Z. Inst.*, vol. 7, p. 458, pl. 21 (not of Lamk. 1835).

1887 *Venus sulcata* Hutton, *Proc. Lin. Soc. N.S.W.* (2) vol. 1, p. 226

1915 *Cytherea (Circomphalus) sulcata* (Hutton): Suter, *N.Z. Geol. Surv. Pal Bull.* No. 2, p. 58.

Hutton's type and only specimen is embedded in a hard matrix which conceals the interior. A smooth margin can be distinguished, however, so this shell is not allied to *Venus* or *Cytherea* Bolten. The late Mr. R. Murdoch kindly sent along the specimen from Waipipi which had been identified as *Paphia curta* (Marsh. and Murd. 1920, p. 125) and it was found to agree in every way with Hutton's *V sulcata.* In the left valve the posterior cardinal is long and straight, separated from the nymph by a shallow groove, the median cardinal is fairly thick and equally divided, the anterior triangular and entire.

Localities: Napier limestone, type; 1101, Waipipi Beach, Waverley.

5. Genus GOMPHINA Moerch, 1853.

Type: *Venus veneriformis* Lamk. (= *donacina* Chemnitz)

a. Subgenus **Gomphina** s. str.

Shell of moderate size, trigonal, anterior end narrowly rounded, posterior end produced, obliquely truncated to form well-marked posterior area. Lunule long, very narrow, impressed with shallow but definite bounding line; escutcheon slightly concave, not well defined. Sculpture on anterior area consisting of weak, bevelled, concentric grooves, becoming obsolete on centre of disc, posterior area, excepting escutcheon with weak radials crossed by strong growth-ridges. Left valve with three rather narrow, straight, divergent cardinals, median grooved. Right valve with straight, narrow, grooved, posterior cardinal; broadly-triangular, grooved median, and lamellar anterior one. Pallial sinus moderate, oval, horizontal. Valve margins smooth.

b. Subgenus **Gomphinella** n. subgen.

Type: *Gomphina maorum* Smith.

Shell small, subtrigonal, anterior end long, narrowly rounded; posterior short, broadly truncated. Lunule and escutcheon not defined. Sculpture of weak concentric ridges. Hinge-teeth widely divergent, grooving superficial, right median bevelled, not grooved. Pallial sinus short, arcuate. Valve-margins smooth.

G. maorum differs from *G. veneriformis* Lamk. the type of *Gomphina* in its small size, short, broad posterior end, undefined lunule, shallow pallial sinus, bevelled right median cardinal curving forward, and in the absence of radials on the posterior area.

G. veneriformis is from Japan and it is of interest to note that other species from that area closely resemble the New Zealand shell. *Gomphina neastartoides* (Yokayama) Pliocene and Recent, is intermediate both in size and in shape between *G. maorum* and *G. veneriformis.* Its posterior area has no radials, its right median cardinal is bevelled and ungrooved, and its pallial sinus is quite short. It therefore seems to belong to the subgenus *Gomphinella* rather than to *Gomphina sensu stricto.*

Gomphina (Gomphinella) maorum Smith. (Figs. 213-5.)

1902 *Gomphina maorum* Smith, *Journ. of Malac.* vol. 9, p. 109. Text figs.

1913 *Gomphina maorum* Smith: Suter, *Man. N.Z. Moll.*, p. 993, pl. 63, fig. 15.

Localities: Recent, type; Kaawa Creek.

The fossils have not been compared with any recent specimens so their specific identification remains uncertain.

6. Genus Paphia Bolten, 1798.

Type: *P. ala-papilionis* Bolten.

Shell oval. Lunule shallow, long, lanceolate, bounded by weak line and slight ridge, right side encroaching on left; escutcheon narrow, not well defined. Sculpture of rather broad, low, bevelled, close, concentric ridges weakening on posterior. Hinge area small, teeth all rather narrow, embracing an angle of only 90° in right valve and less in left. Right posterior and median, and left median cardinals bifid; both posterior cardinals separated from nymph by a very wide space. Pallial sinus fairly long and narrow, rounded at end, ascending. Pedal retractor very large, separated from adductor. Valve-margins smooth.

The generic separation of *Paphia* from *Tapes* is demanded by the great difference in the hinge. Cossmann and Peyrot's figure (1911, p. 304) of the hinge of *T. litteratus* is not correct. The left median cardinal (2b) is shown as a very narrow tooth whereas it is really an extremely wide, deeply-grooved one. In his sketch the supposed anterior cardinal (2a) seems to represent the front flange of this median tooth and 2b the posterior flange, and the true anterior cardinal is missing. The figure of the right valve is correct and the wide space between the posterior (3b) and the median (1) cardinals clearly shows the discrepancy in the left valve. The hinges of the genotypes of *Paphia* and *Tapes* are figured below for comparison.

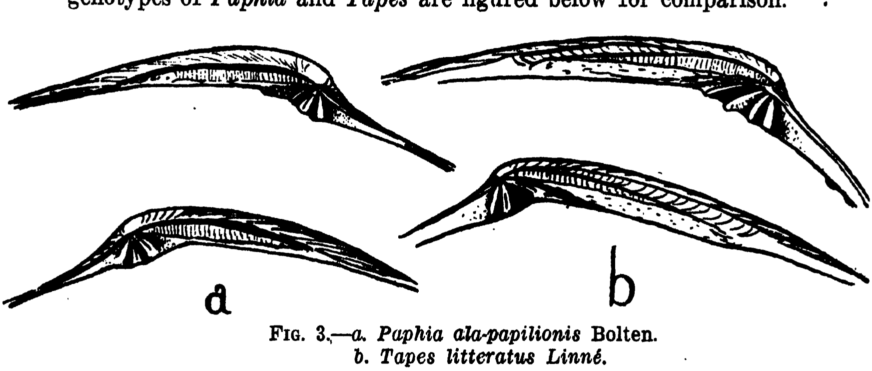


Fig. 3.—*a. Paphia ala-papilionis* Bolten.
b. Tapes litteratus Linné.

a. Subgenus **Callistotapes** Sacco 1900.

Type: *Venus vetula* Basterot.

Dall considered *Callistotapes* synonymous with *Paphia*, but the hinge of *P. vetula* has the cardinal teeth much more divergent, and the left posterior cardinal is near the ligamental nymph, not widely separated from it.

Paphia (Callistotapes) finlayi n. sp. (Figs. 208, 209.)

Shell rather small, oval-oblong. Lunule superficial; escutcheon not sunken. Sculpture of strong, erect, sharp, close concentric ridges. Hinge narrow, teeth widely divergent; right posterior cardinal moderately strong, grooved; median narrow, probably grooved, anterior narrow, entire. Valve-margins smooth.

Holotype in collection of Mr. H. J. Finlay.

Height 24·5 mm., length 37 mm., thickness (one valve) 8 mm.

Locality: 7A, Clifden.

Until more material is available the generic position is not without doubt.

7. Genus PAPHIRUS Finlay, 1927.

Type: *V. largillierti* Philippi. (= *V. intermedia* Q. & G.).

Shell fairly large, oval-oblong. Lunule not impressed, scarcely defined; escutcheon extremely narrow, insignificant, with raised ligamental margins. Sculpture of rounded, concentric, sometimes bifurcating threads becoming stronger ventrally; they are crossed by weak crowded, waved, radial grooves; posterior area with bevelled concentric ridges, the lower edge sharply raised, each ridge about as wide as three of the concentric threads. Hinge narrow, teeth concentrated, posterior cardinal joined to nymph; median moderately thick, deeply divided, projecting below hinge-margin; anterior rather narrow, obscurely grooved. Right valve with moderate, well-grooved, posterior cardinal projecting slightly below hinge-margin; median cardinal somewhat narrower, grooved; anterior cardinal entire. Pallial sinus ample, rounded, slightly ascending. Pedal retractor separated from adductor. Valve-margins smooth.

The hinge of *Paphirus* is almost the same as that of *Ruditapes* so the two groups must be fairly closely related; but the sculpture is somewhat different owing to the radial element in *Paphirus* being much weaker. On the posterior area of *Ruditapes decussatus* (Linné) the radials are particularly strong and rugose, while on that of Paphirus the radials are obscure and there are strong concentric, bevelled ridges, similar to those of *Tapes litteratus* Linné. Except on the posterior area, the sculpture of *P. largillierti* closely resembles that of *Pullastra pullastra* Mont., but the teeth are not subparallel and narrow as in that genus.

Paphirus largillierti (Philippi). (Figs. 166, 167, 169.)

1835 *Venus intermedia* Q. & G., *Voyage of the Astrolabe,* vol. 3, p. 526, pl. 84, figs. 9, 10 (not of Serres).

1927 *Paphirus largillierti* (Phil.): *Finlay* (this volume, p. 471.)

For full synonymy see *Paphia intermedia* Q. & G.: Suter, *Manual N.Z. Moll.* p. 995 to which add *Tapes fabagella* Desh., *Cat. Conchif. Brit. Mus.,* 1853, p. 182.

Localities: Recent, type: Landguard Bluff; Castlecliff; Maraekakaho; Nukumaru.

The shells usually identified as *fabagella* are young examples of *P. largillierti,* it seems likely that Deshayes's type is the same or is not a New Zealand shell.

8. Genus Irona Finlay 1927.

Type: *Venerupis reflexa* Gray.

Shell oblong-oval, irregular in shape according to station. Lunule not impressed, bounding line very weak or absent; escutcheon absent from right valve, narrow but well defined in left. Sculpture of sharp, spaced, concentric lamellae, interspaces with several waved concentric threads sometimes bifurcating. Left hinge with narrow posterior cardinal, joined to nymph and projecting beyond hinge-margin below; median cardinal fairly strong, well grooved, also projecting; anterior cardinal very high, entire. Right hinge with posterior and median cardinals fairly strong, grooved and projecting, anterior cardinal narrow, entire. Nymphs broad anteriorly depressed. Pallial sinus ample, oval, slightly ascending. Valve margins smooth.

Jukes-Browne thought that *V. reflexa* belonged to *Pullastra*, but the teeth of that genus are all thin, concentrated, and subparallel. The hinge of *Irona* on the other hand is very like that of *Paphirus*, the chief differences being that the teeth of *Irona* project to a greater extent beyond the hinge-margin. Indeed it appears likely that *Irona* is an offshoot from ancestors of *Paphirus* for the young shells possess many points in common with adult *Paphirus*. Juvenile *I. reflexa* of about 5 mm. length can scarcely if at all be distinguished from *P. largillierti* of the same dimensions. The greater part of the surface is covered with fine, sometimes bifurcating, somewhat waved concentric threads often with traces of fine radial lines. On the posterior area, are almost flat, slightly bevelled, concentric ridges each comprising about three threads; the steep face of the ridge is facing ventrally. It is from these steep faces that arise the sharp concentric ridges of the adult *I. reflexa*. In the young stages, they occur only on the posterior area, but they soon advance across the disc and become the dominant feature of the sculpture.

Irona reflexa (Gray). (Figs. 188-90.)

1843 *Venerupis reflexa* Gray, Dieffenbach's *Travels in N.Z.*, vol. 2, p. 250.

1854 *Venerupis siliqua* Deshayes, *Proc. Zool. Soc.*, p. 5, pl. 18, fig. 1.

1923 *Venerupis reflexa* Gray: Oliver, *Proc. Malac. Soc.*, vol. 15, p. 185.

1926 *Irona reflexa* (Gray): Finlay (this volume).

For further synonymy see Suter's *Manual*, p. 998 and 999. This Recent shell has been found fossil only at one spot, locality 689, Raised Beach, Mahia Peninsula (Pleistocene).

References.

Bartrum, J. A., 1919. Fossiliferous Bed at Kawa Creek, *Trans. N.Z. Inst.*, vol. 51, pp. 101–106.

Cossmann, M., 1917, in Marshall, Additional Fossils from Target Gully, *Trans. N.Z. Inst.*, vol. 49, pp. 461–2.

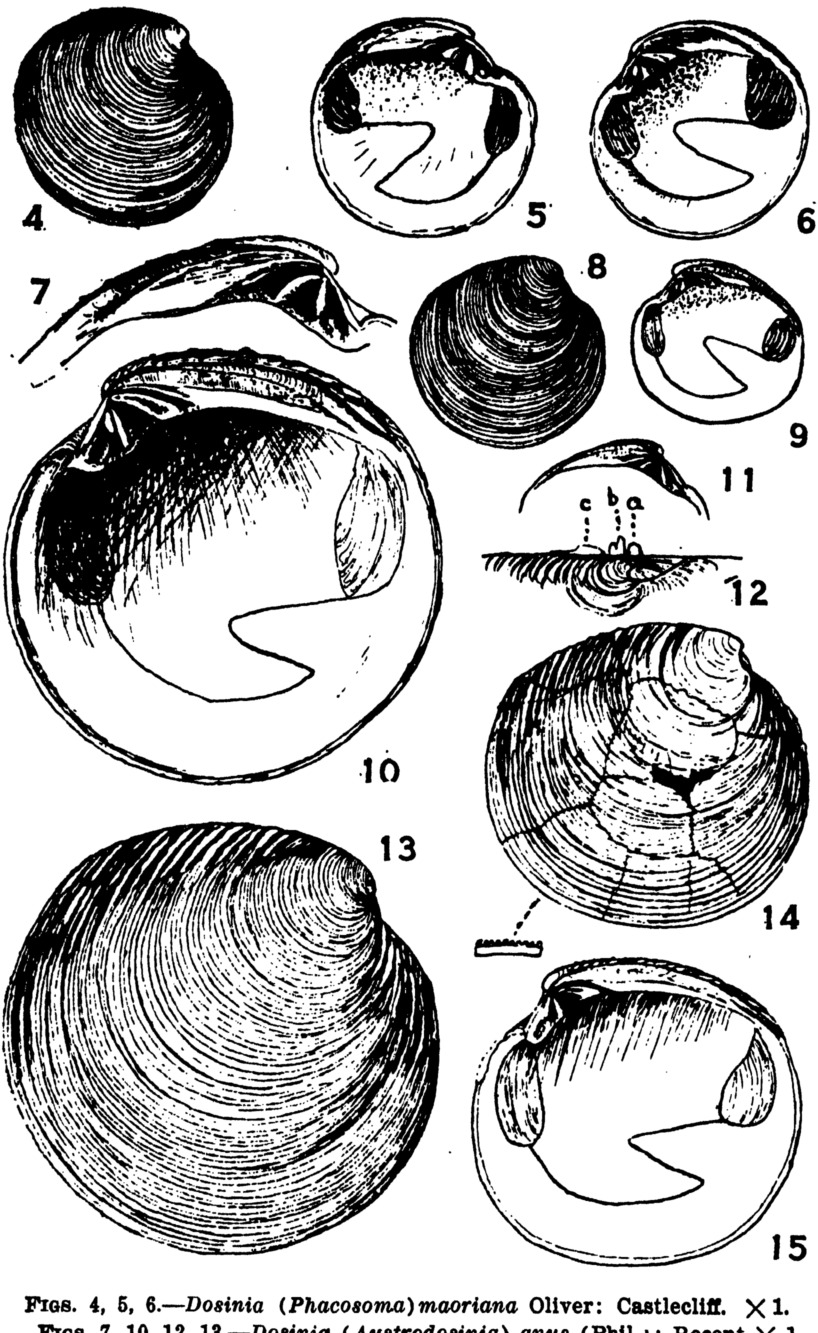
——, and Peyrot, A., 1911. *Conchologie Néogénique de l'Aquitaine*, tome 1, Pelecypodes, livr. 2.

Dall, W. H., 1903. Tertiary Fauna of Florida, *Trans. Wagner Free Inst.*, vol. 3, part 6.

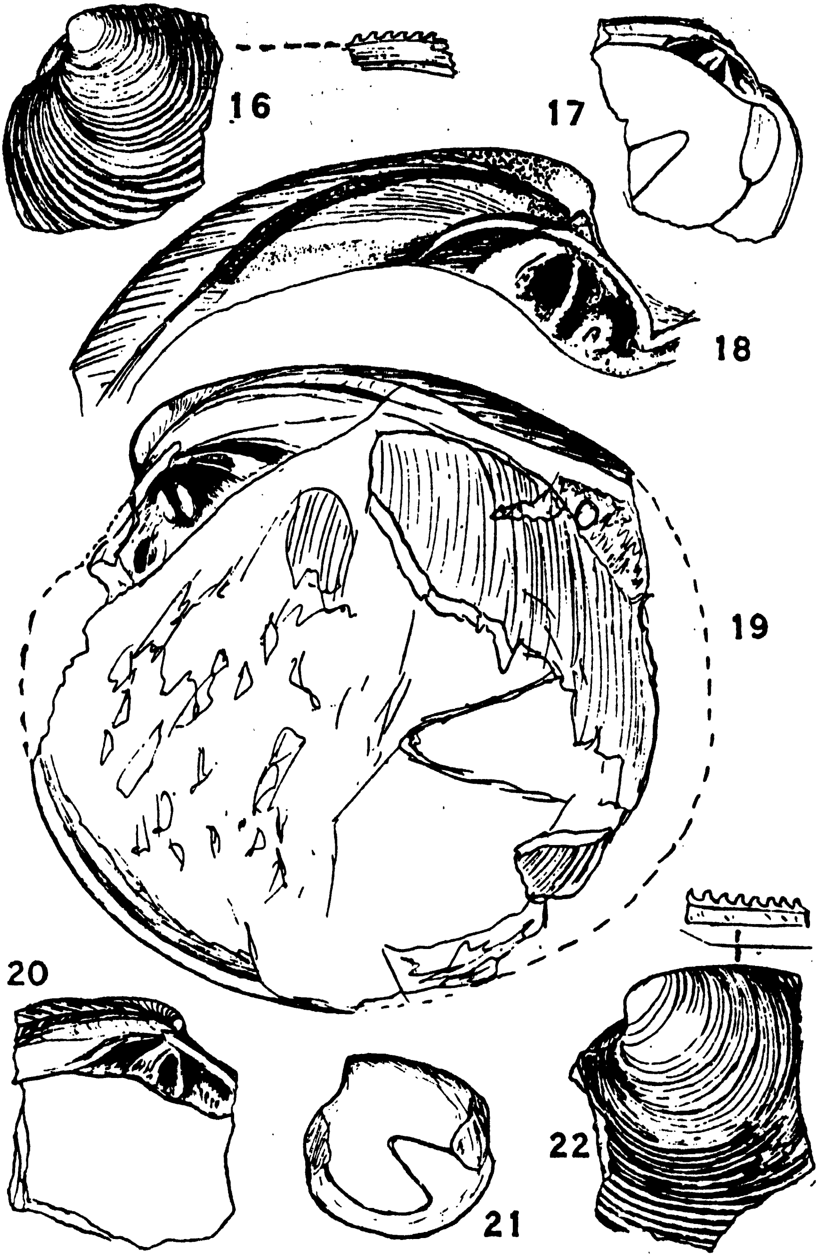
Deshayes, G. P., 1853. *Cat. Conch. Brit. Mus.*

Finlay, H. J., 1927. Further Commentary on N.Z. Molluscan Systematics. *Trans. N.Z. Inst.*, vol. 57, pp. 320-485.

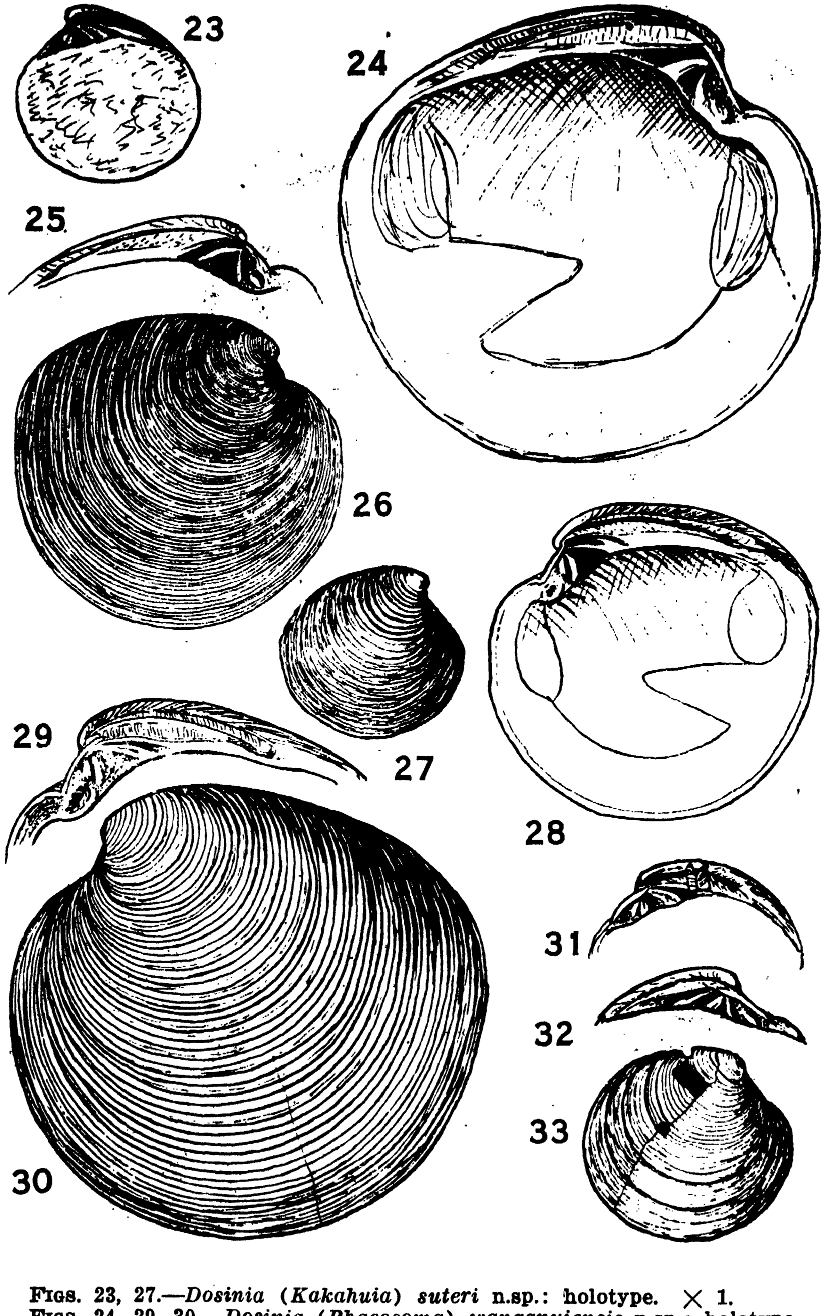
FISCHER, P., 1887. *Manuel de Conchyliologie.*
GRANGE, L. I., 1926. Geology of Upper Waitotara Valley, Taranaki, *Trans. N.Z. Inst.*, vol. 56, pp. 331–36.
GUPPY, R. J. L., 1866. *Quart. Jour. Geol. Soc.*, vol. 22.
HUTTON, F. W., 1873. *Catalogue of the Tertiary Mollusca and Echinodermata of New Zealand.*
—— 1886. The Wanganui System, *Trans. N.Z. Inst.*, vol. 18, pp. 336–67.
—— 1893. The Pliocene Mollusca of N.Z., *Macleay Memor. Vol., Lin. Soc. N.S.W.*, pp. 35–92.
HENDERSON, J. and ONGLEY, M., 1923. Mokau Subdivision, *N.Z. Geol. Surv. Bull.* No. 24 (N.S.)
IHERING, H. VON, 1907. Les moll. foss. du Tert. et du Crét. Sup. de l'Argentine, *Anal. del Mus. Nac. de Buenos Aires*, ser. 3, tomo 7.
—— 1921. De Geschichte der Venus-Muscheln, *Archiv. f. Molluskenkunde*, heft 3, pp. 125–139.
IREDALE, T., 1915. Commentary on Suter's Manual, *Trans. N.Z. Inst.*, vol. 47, pp. 417–497.
—— 1917. More Mollusc. Name Changes, *Proc. Malac. Soc.*, vol. 12, pt. 6, pp. 322–330.
—— 1924. Results from Roy Bell's Molluscan Collections, *Proc. Linn. Soc. N.S.W.*, vol. 49, pt. 3.
JUKES-BROWNE, A. J., 1908. Genera of Veneridae in Cretac. and Old Tert., *Proc. Malac. Soc.*, vol. 8, pp. 148–177.
—— 1909. Application of *Gomphina, Marcia, Hemitapes,* and *Katelysia, Proc. Malac. Soc.*, vol. 8, pp. 223–246.
—— 1912. *Dosinia* and its Subdivisions, *Proc. Malac. Soc.*, vol. 10, part 2, pp. 95–104.
—— 1913. *Callista, Amiantis* and *Pitaria, Proc. Malac. Soc.*, vol. 10. pp. 335–347.
—— 1914. Synopsis of the Veneridae, *Proc. Malac. Soc.*, vol. 11, pp. 58–94.
MARWICK, J., 1924. A. Exam. of Tert. Moll. of Aust. and N.Z., *Rep. Aust. Ass. Adv. Sci.*, vol. 16.
—— 1924. B. Notes on a Molluscan Collection of Supposed Waiarekan Age, *N.Z. Jour. Sc. and Tech.*, vol. 6, p. 280.
MARSHALL, P., 1917. Additional Fossils from Target Gully, *Trans. N.Z. Inst.*, vol. 49, pp. 461–2.
—— 1918. The Molluscan Fauna of Pakaurangi, *Trans. N.Z. Inst.*, vol. 50, pp. 263–278.
—— 1923. Early Tertiary Molluscan Faunas of N.Z., *Trans. N.Z. Inst.*, vol. 54, pp. 115–121.
—— and MURDOCH, R., 1920. Tertiary Rocks near Wanganui, *Trans. N.Z. Inst.*, vol. 52, pp. 115–128.
—— 1921. Fossils from Paparoa Rapids, *Trans. N.Z. Inst.*, vol. 53, pp. 85–86.
MEEK, F. B., 1876. Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country, *United States Geol. Surv. of the Territories*, vol. 9.
OLIVER, W. R. B., 1923. Notes on N.Z. Pelecypodes, *Proc. Malac. Soc.*, vol. 15, pp. 179–188.
PARK, J., 1918. Geol. of Oamaru Dist., *N.Z. Geol. Surv. Bull.* No. 20 (N.S.)
ROEMER, E., 1863. *Novitates Conchologicae*, 2 Abt., 1 Suppl., *Dosinia.*
SMITH, E., 1885. Lamellibranch., *Challenger Rep.*, vol. 13, pt. 1.
SUTER, H., 1913. *Manual of N.Z. Mollusca.*
—— 1914. *N.Z. Geol. Surv. Pal. Bull.* No. 2.
—— 1915. *N.Z. Geol. Surv. Pal. Bull.* No. 3.
—— 1917. *N.Z. Geol. Surv. Pal. Bull.* No. 5.
—— 1918. *Alphabetical List of N.Z. Tert. Moll.*
—— 1921. *N.Z.G.S. Pal. Bull.* No. 8.
TATE, R., 1887. Lamellibr. of Older Tert. of Austr., pt. 2, *Trans. Roy. Soc. Sth. Aust.*, vol. 9.
VAUGHAN, T. W., 1924. Criteria & Status of Correlation & Classification of Tert. Deposits, *Bull. Geol. Soc. Am.*, vol. 35.
WHITE, C. A., 1888. Contrib. Pal. Brazil, *Archiv. do Museu Nacional do Rio de Janeiro*, vol. 7.
WOODS, H., 1917. *N.Z. Geol. Surv. Pal. Bull.* No. 4.
WOODRING, W. P., 1925. Miocene Mollusks from Bowden, Jamaica, *Carnegie Inst. of Washington*, publication no. 366.



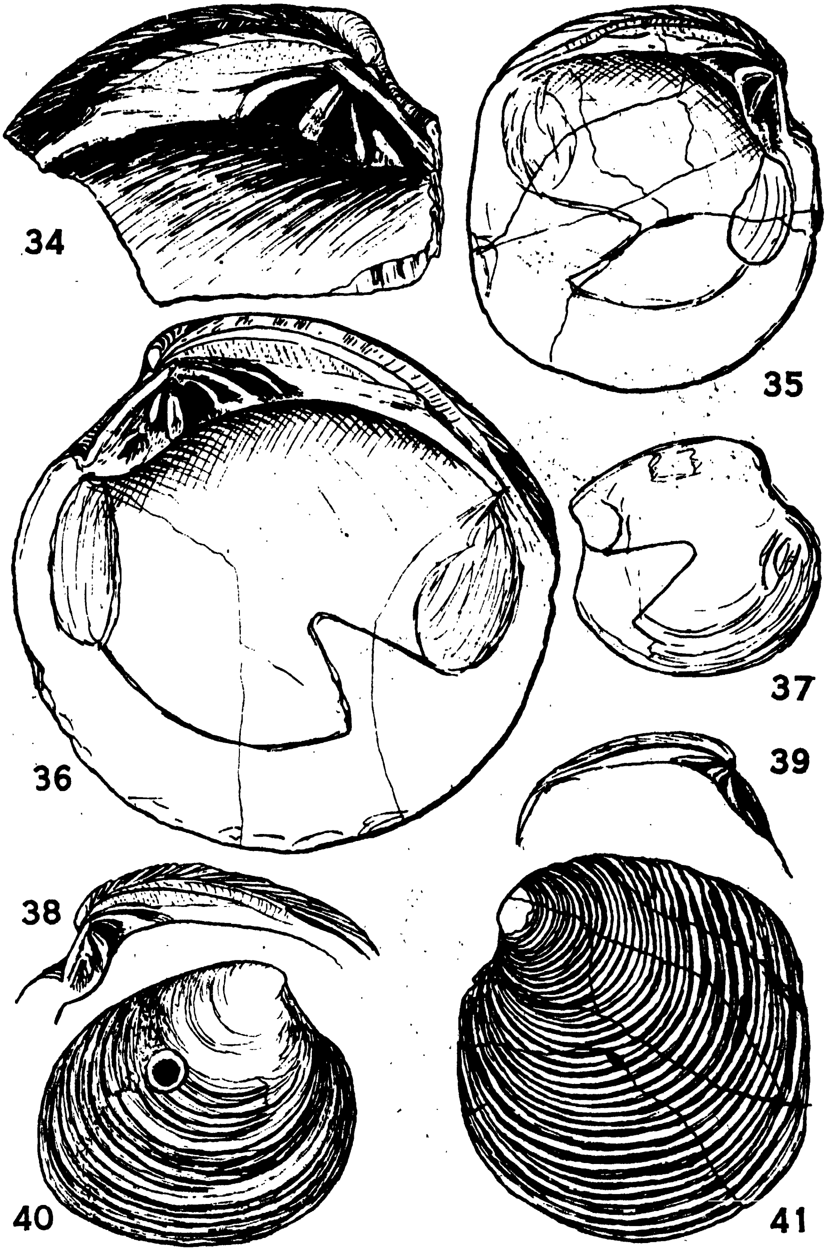
Figs. 4, 5, 6.—*Dosinia* (*Phacosoma*) *maoriana* Oliver: Castlecliff. × 1.
Figs. 7, 10, 12, 13.—*Dosinia* (*Austrodosinia*) *anus* (Phil.): Recent × 1.
Figs. 8, 9, 11.—*Dosinia* (*Dosinia*) *lambata* (Gould): Castlecliff. × 1.
Figs. 14, 15.—*Dosinia* (*Austrodosinia*) *kaawaensis* n.sp.: holotype. × 1.



FIGS. 16, 17.—*Dosinia* (*Kereia*) *densicosta* n.sp.: holotype. × 1.
FIGS. 18, 19.—*Dosinia* (*Austrodosinia*) *magna* Hutton: holotype and ? topotype. × 1.
FIGS. 20, 22.—*Dosinia* (*Austrodosinia*) *waitakiensis* n.sp.: holotype. × 1.
FIG. 21.—*Dosinia* (*Kereia*) *mackayi* n. sp.: paratype. × 1.



Figs. 23, 27.—*Dosinia* (*Kakahuia*) *suteri* n.sp.: holotype. × 1.
Figs. 24, 29, 30.—*Dosinia* (*Phacosoma*) *wanganuiensis* n.sp.: holotype and paratype. × 1.
Figs. 25, 26, 28.—*Dosinia* (*Phacosoma*) *subrosea* (Gray): Recent. × 1.
Figs. 31, 32, 33.—*Dosinia* (*Kereia*) *mackayi* n.sp.: holotype and paratype. × 1.



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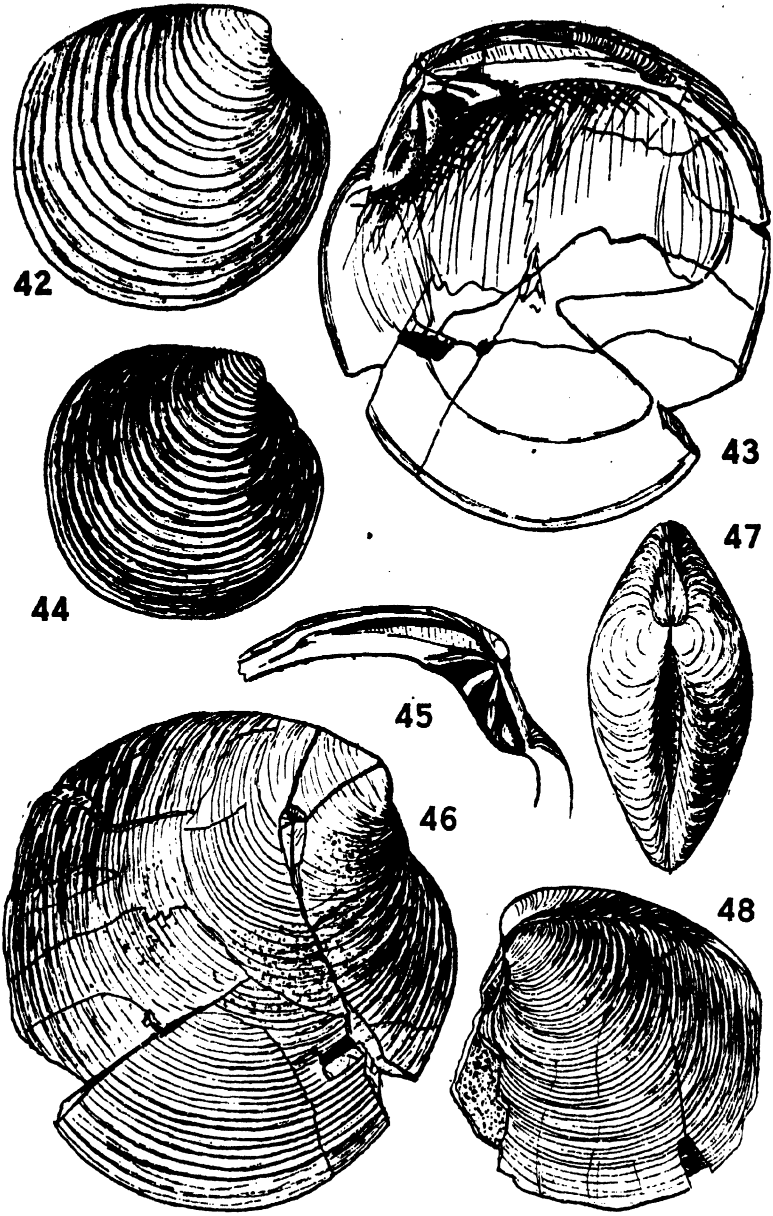
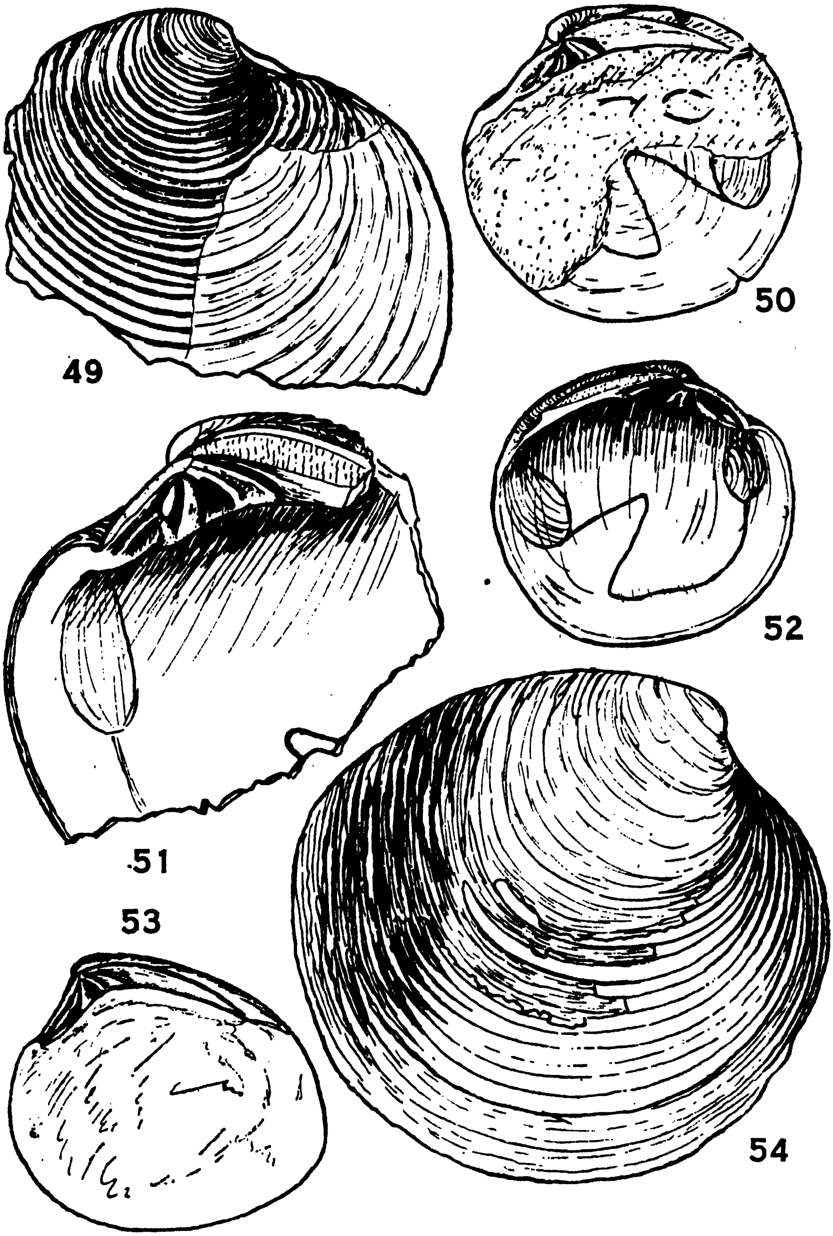
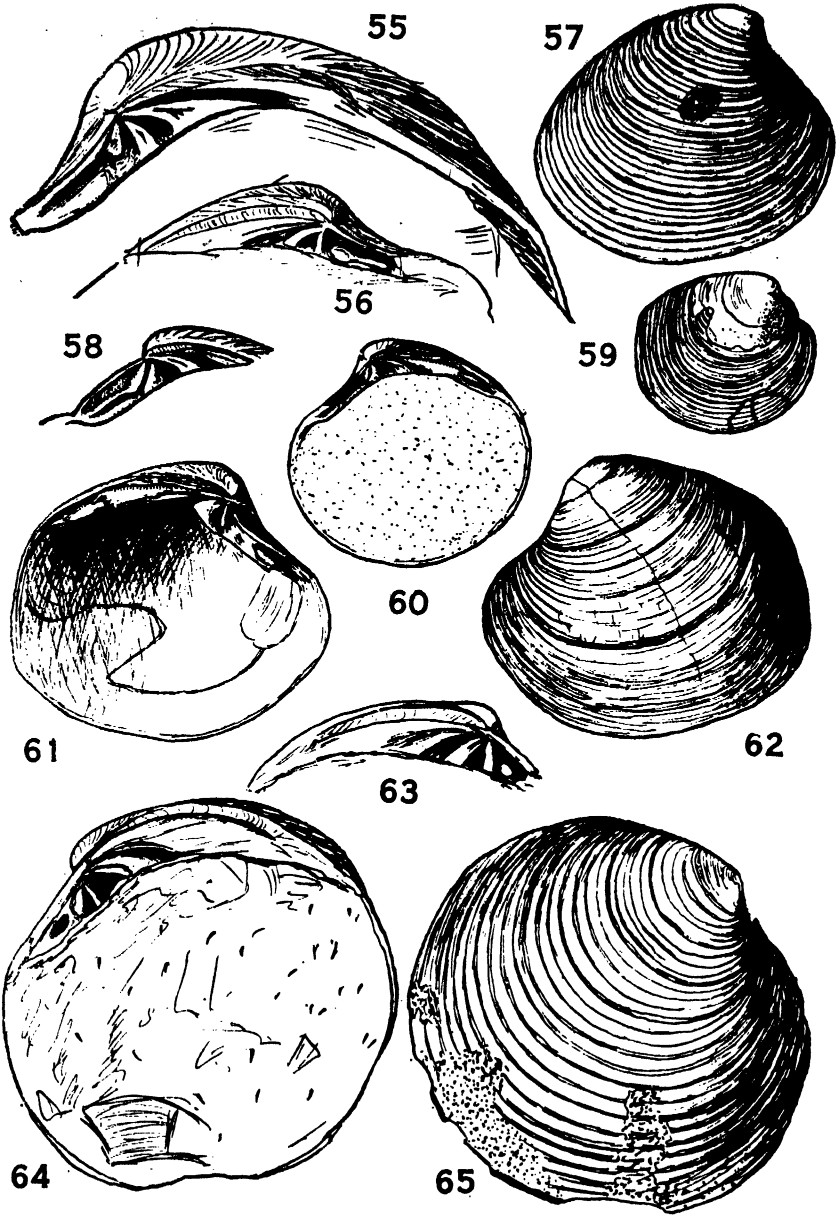
FIGS. 34, 36.—*Dosinia* (*Raina*) *bensoni* n.sp.: paratype and holotype. × 1.
FIGS. 35, 38, 41.—*Dosinia* (*Austro-dosinia*) *horrida* n. sp.: holotype and paratype. × 1.
FIGS. 37, 39.—*Dosinia* (*Kereia*) *ongleyi* n.sp.: paratypes. × 2.
FIG. 40.—*Dosinia* (*Kereia*) *perplexa* n.sp.: holotype. × 2.



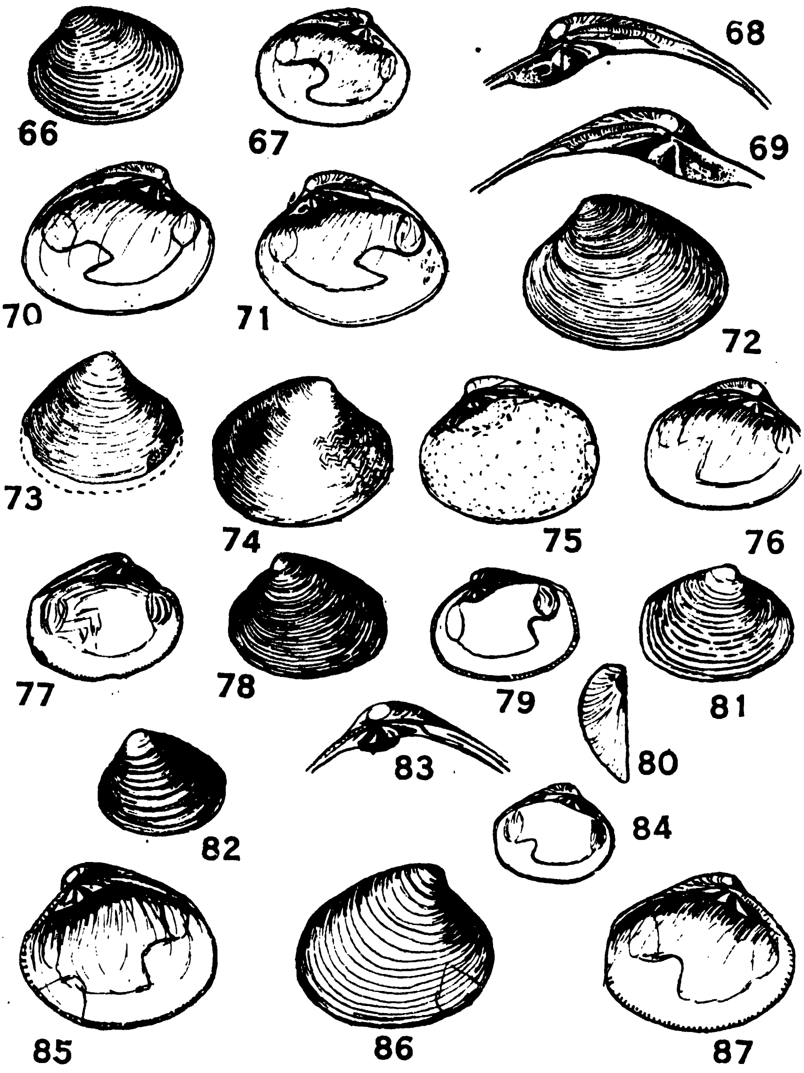
Figs. 42, 47.—*Dosinia* (*Kereia*) *cottoni* n.sp.: holotype. × 1.
Figs. 43, 45, 46.—*Dosinia* (*Raina*) *nukumaruensis* n.sp.: holotype and paratype. × 1.
Fig. 44.—*Dosinia* (*Kereia*) *greyi* Zittel. Kai-iwi. × 1.
Fig. 48.—*Dosinia* (*Kereia*) *waiparaensis* n.sp. holotype. × 1.



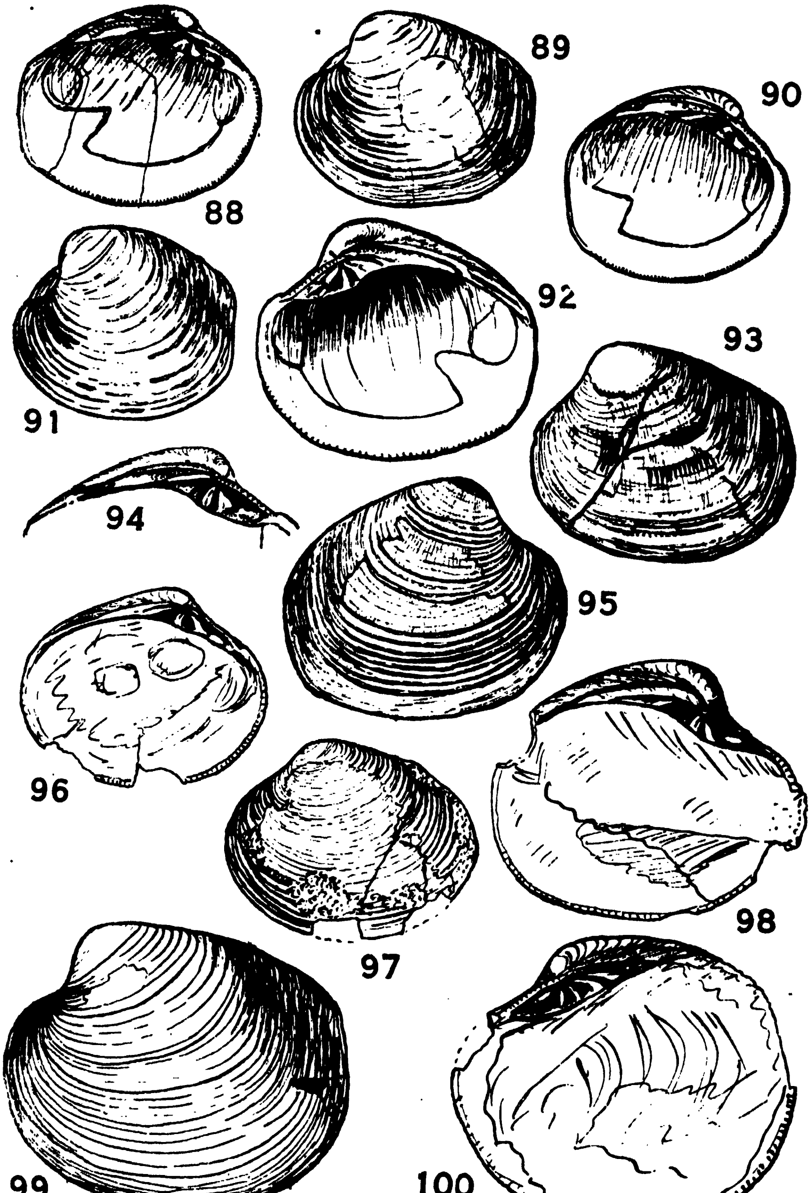
Figs. 49, 51.—*Dosinia* (*Raina*) *waipipiensis* n.sp.: holotype. × 1.
Figs 50, 52.—*Dosinia* (*Kereia*) *greyi* Zittel: Waipipi and Kai-iwi. × 1.
Fig. 53.—*Dosinia* (*Kereia*) *perplexa* n.sp.: holotype. × 2.
Fig. 54.—*Dosinia* (*Raina*) *bensoni* n.sp.: holotype. × 1.



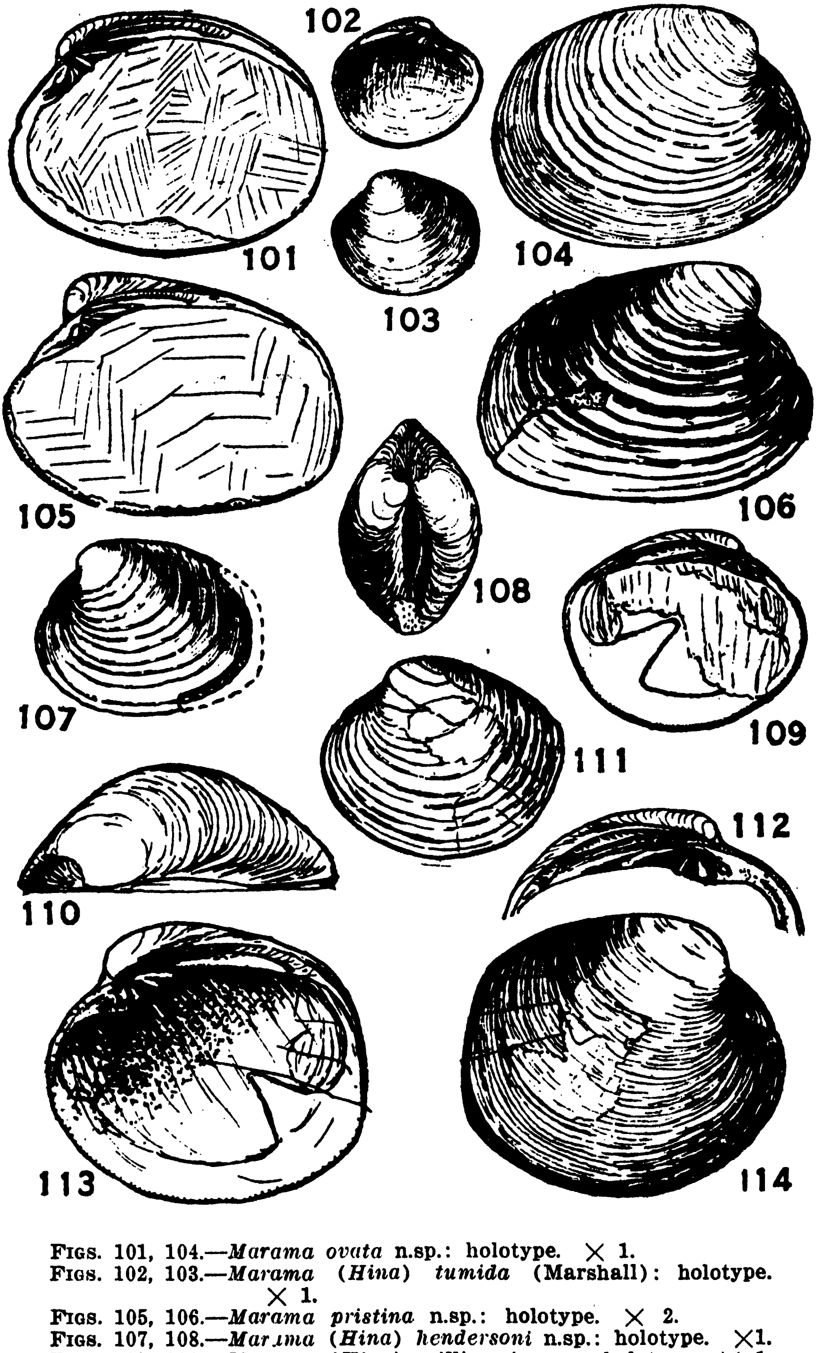
Figs. 55, 56.—*Callistina* (*Tikia*) *thomsoni* (Woods): syntypes. × 1.
Fig. 57.—*Callistina* (*Tikia*) *wilckensi* (Woods): syntype. × 1.
Fig. 58.—*Dosinia* (*Kereia*) *ongleyi* n.sp.: holotype. × 4.
Fig. 59.—*Dosinia* (*Kereia*) *ongleyi* n.sp.: holotype. × 1½.
Figs. 60, 61, 62.—*Finlaya parthiana* n.sp.: paratype and holotype. × 1.
Figs. 63, 64, 65.—*Dosinia* (*Raina*) *paparoaensis* n.sp.: paratype and holotype. × 1.



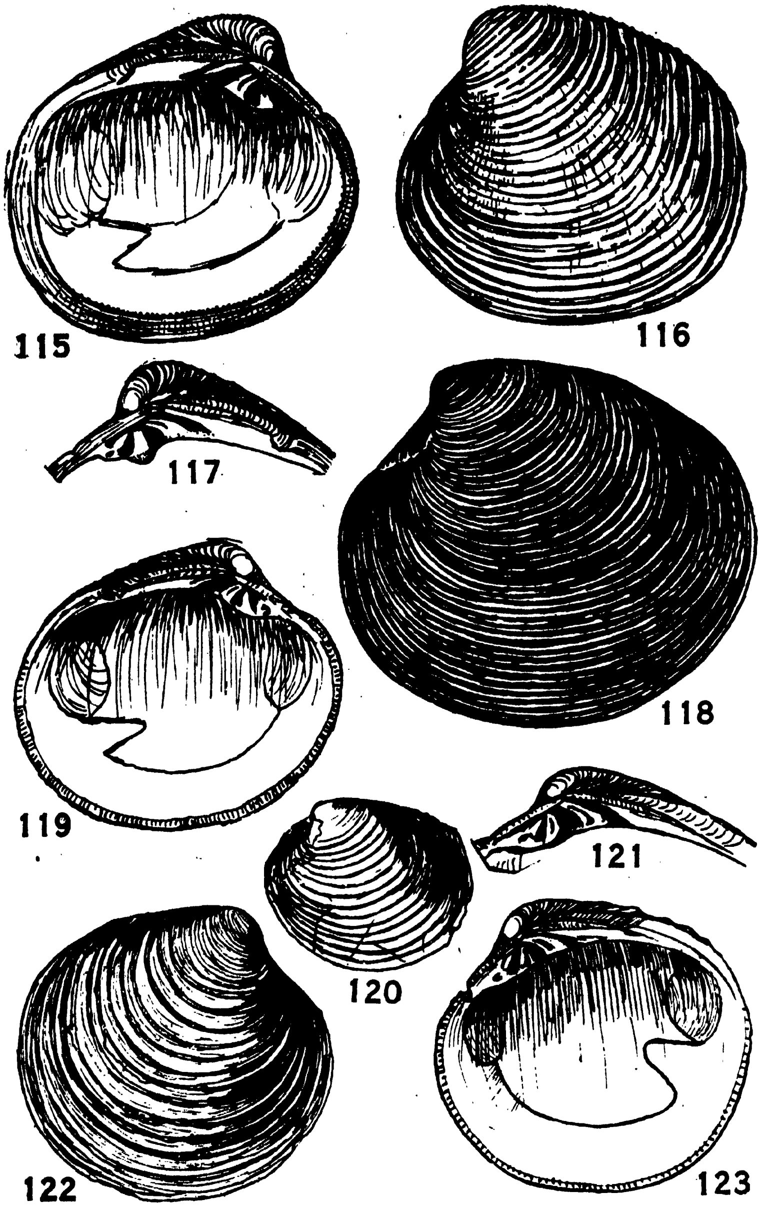
FIGS.—66, 67.—*Paradione* (*Notocallista*) *parki* n.sp.: holotype. × 1.
FIGS. 68, 69.—*Paradione* (*Notocallista*) *parki* n.sp.: paratype and holotype. × 2.
FIGS. 70, 71, 72.—*Paradione* (*Notocallista*) *multistriata* (Sowb.): Castlecliff. × 1.
FIG. 73.—*Paradione* (*Notocallista*) *trigonalis* n.sp.: holotype. × 1.
FIGS. 74, 75.—*Pitar* (*Hyphantosoma*) *sculpturatus* (Marshall): holotype. × 1.
FIG. 76.—*Pitar* (*Hyphantosoma*) *sculpturatus* (Marshall): Clifden. × 1½.
FIGS. 77, 78.—*Turia bortonensis* n.sp.: holotype. × 2.
FIGS. 79, 80, 81.—*Turia pukeuriensis* n.sp.: holotype. × 3.
FIGS. 82, 84.—*Turia waiauensis* n.sp.: holotype. × 3.
FIG. 83.—*Turia waiauensis* n.sp.: paratype. × 5.
FIGS. 85, 86, 87.—*Turia chattonensis* n.sp.: holotype and paratype. × 5.



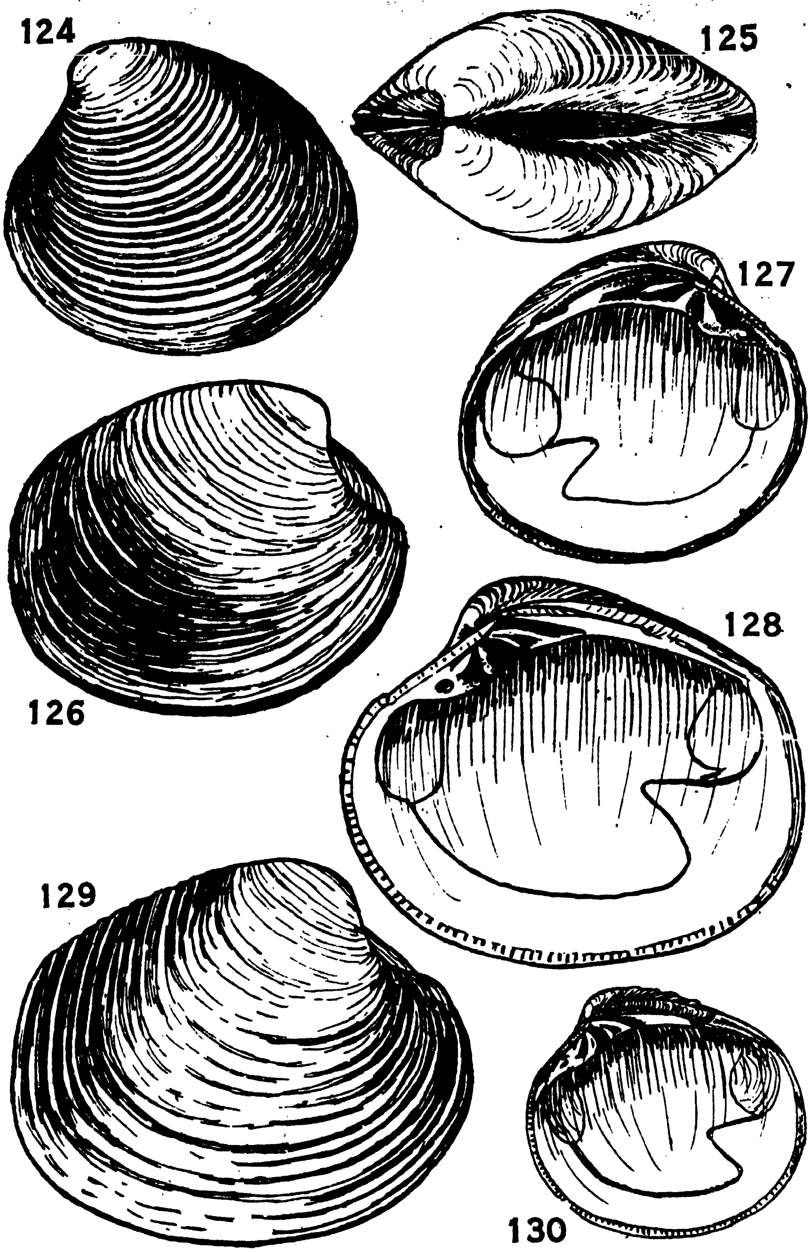
FIGS. 88, 89.—*Marama* (*Hina*) *mackenziei* n.sp.: holotype. × 1.
FIGS. 90, 91.—*Marama* (*Hina*) *pinguis* n.sp.: holotype. × 1.
FIGS. 92, 94, 95.—*Kuia vellicata* (Hutton): Target Gully. × 1.
FIG. 93.—*Kuia vellicata* (Hutton): holotype. × 1.
FIGS. 96, 97.—*Kuia singularis* n.sp.: holotype. × 1.
FIGS. 98, 100.—*Kuia macdowelli* n.sp.: paratypes. × 1.
FIG. 99.—*Kuia macdowelli* n.sp.: holotype. × 1.



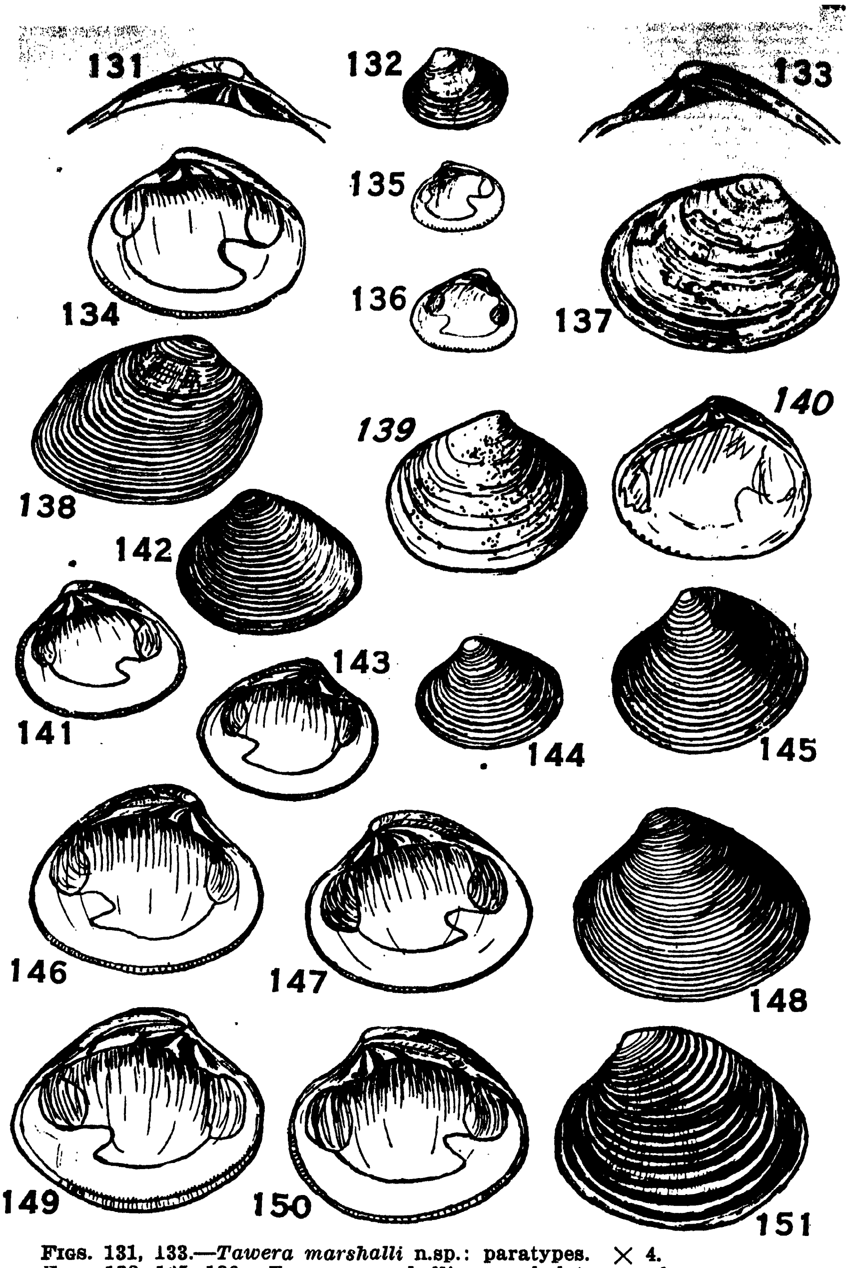
FIGS. 101, 104.—*Marama ovata* n.sp.: holotype. × 1.
FIGS. 102, 103.—*Marama* (*Hina*) *tumida* (Marshall): holotype. × 1.
FIGS. 105, 106.—*Marama pristina* n.sp.: holotype. × 2.
FIGS. 107, 108.—*Marama* (*Hina*) *hendersoni* n.sp.: holotype. ×1.
FIGS. 109, 111.—*Marama* (*Hina*) *williamsi* n.sp.: holotype. × 1.
FIGS. 110, 113, 114.—*Marama murdochi* n.sp.: holotype. × 1.
FIG. 112.—*Marama murdochi* n.sp.: paratype. × 1.



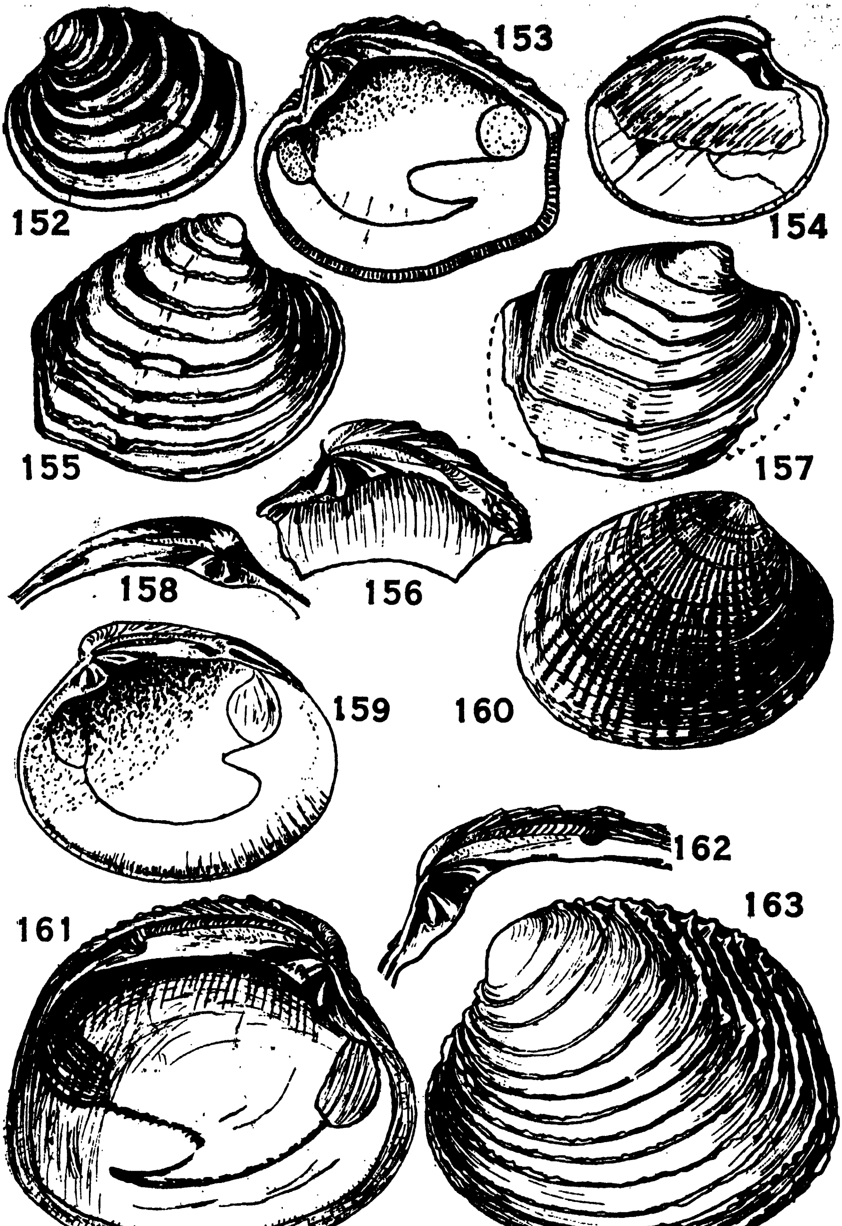
Figs. 115, 116, 117.—*Dosinula crebra* (Hutton): holotype. × 1.
Fig. 118.—*Dosinula zelandica* (Gray): copy of Smith's figure.
Figs. 119, 121.—*Dosinula zelandica* (Gray): Recent. × 1.
Fig. 120.—*Dosinula elegans* (Hutton): holotype. × 1.
Figs. 122, 123.—*Dosinula firmocosta* n.sp.: holotype. × 1.



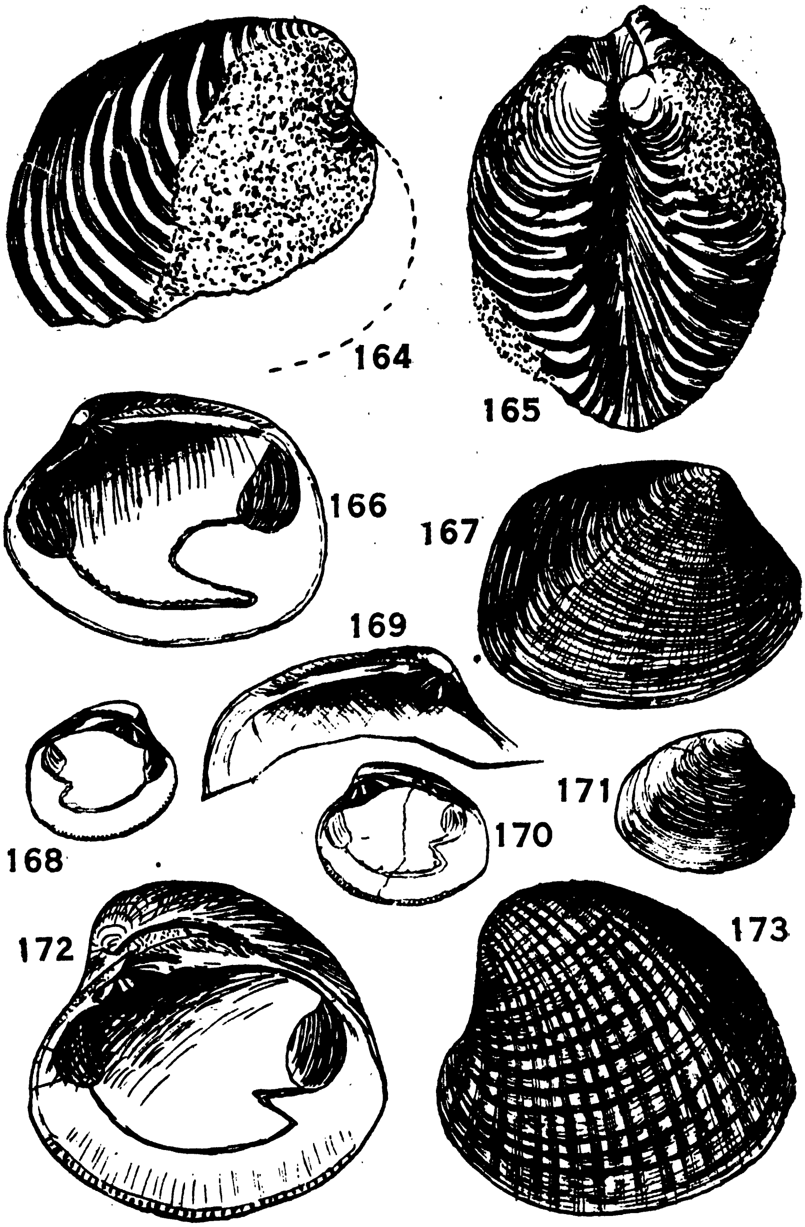
FIGS. 124, 127, 130.—*Dosinula suboblonga* n.sp.: holotype and paratype. × 1.
FIGS. 125, 126.—*Marama hurupiensis* n.sp.: holotype. × 1.
FIGS. 128, 129.—*Dosinula uttleyi* n.sp.: holotype. × 1.



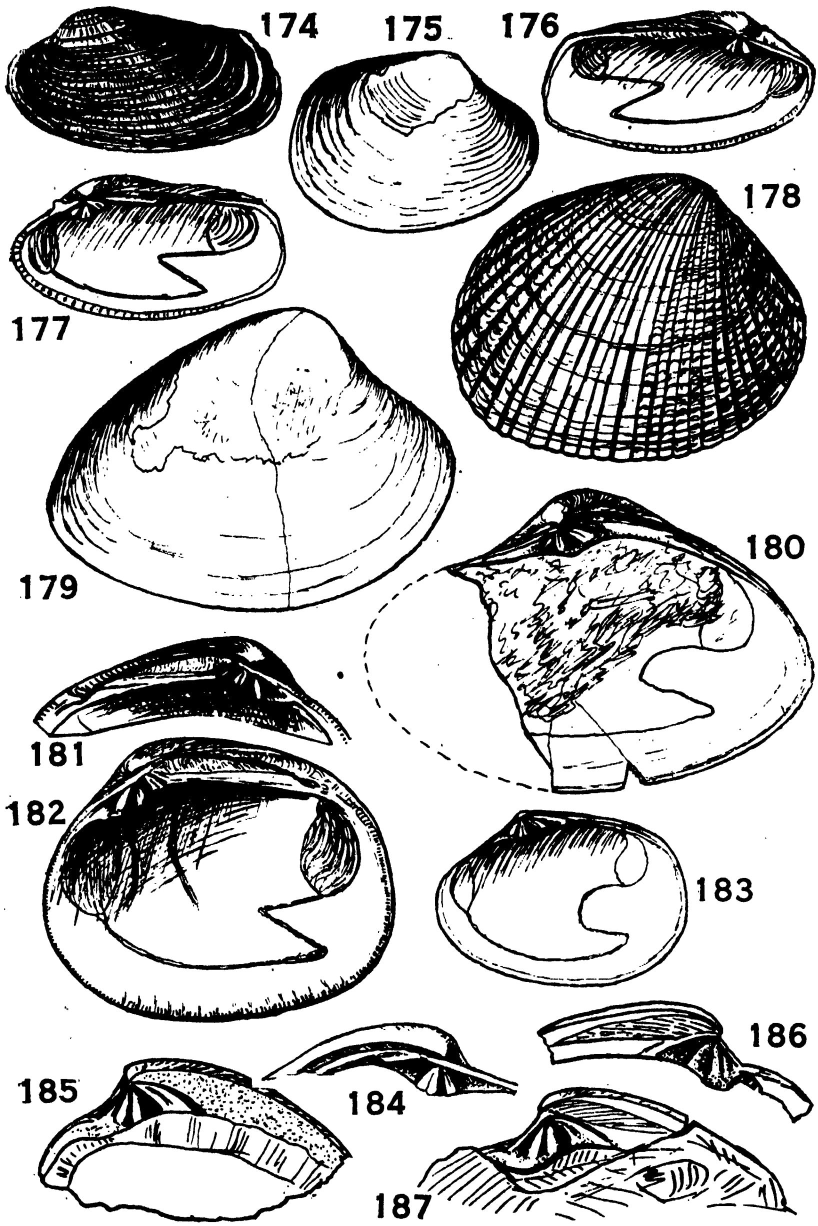
FIGS. 131, 133.—*Tawera marshalli* n.sp.: paratypes. × 4.
FIGS. 132, 135, 136.—*Tawera marshalli* n.sp.: holotype and paratype. × 1.
FIGS. 134, 138.—*Tawera bartrumi* n.sp.: holotype. × 3.
FIG. 137.—*Tawera assimilis* (Hutton): holotype. × 1.
FIGS. 139, 140.—*Tawera errans* n.sp.: holotype. × 1.
FIGS. 141, 142, 143.—*Tawera wanganuiensis* n.sp.: paratype and holotype. × 1.
FIGS. 144, 145.—Quoy and Gaimard's figs. of *V. mesodesma* and *V. spissa*. × 1.
FIGS. 146, 147, 148.—*Tawera spissa* (Q. & G.): Recent. × 1.
FIGS. 149, 150, 151.—*Tawera subsulcata* (Suter): lectotype and topotype. × 1.



Figs. 152, 154.—*Clausinella morgani* (Marwick): holotype. × 1.
Figs. 153, 155.—*Bassina parva* n.sp.: holotype. × 1.
Fig. 156.—*Bassina speighti* (Suter): Chatton. × 1.
Fig. 157.—*Bassina speighti* (Suter): Lower Waipara. × 1.
Figs. 158, 159, 160.—*Chione* (*Austrovenus*) *stutchburyi* (Gray): Castlecliff. × 1.
Figs. 161, 162, 163.—*Bassina yatei* (Gray): Recent. × 1.

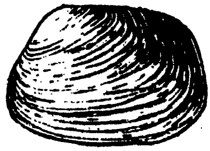


Figs. 164, 165.—*Tawera carri* n.sp.: holotype. × 1.
Figs. 166, 167, 169.—*Paphirus largillierti* (Philippi): Recent. × 1.
Figs. 168, 170, 171.—*Chione* (*Hinemoana*) *acuminata* (Hutton): paratype and holotype. × 1.
Figs. 172, 173.—*Chione* (*Austrovenus*) *crassitesta* Finlay: holotype. × 1.



FIGS. 174, 176, 177.—*Notopaphia elegans* (Desh.): Recent. × 1.
FIGS. 175, 179, 180, 183.—*Eumarcia pareoraensis* (Suter): Pareora. × 1.
FIG. 184.—*Eumarcia pareoraensis* (Suter): paratype. × 2.
FIGS. 178, 181, 182.—*Protothaca* (*Tuangia*) *crassicosta* (Desh.): Recent. × 1.
FIGS. 185, 186, 187.—*Cyclorismina woodsi* n.sp.: paratypes. × 1.

188



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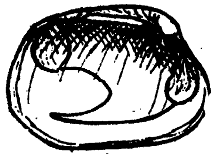

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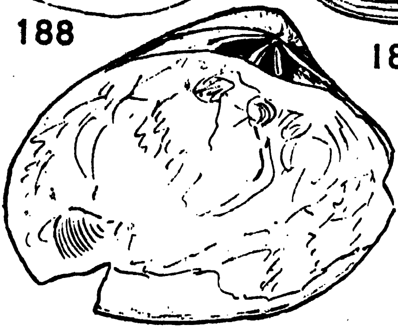

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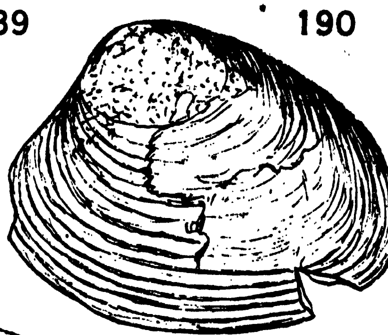

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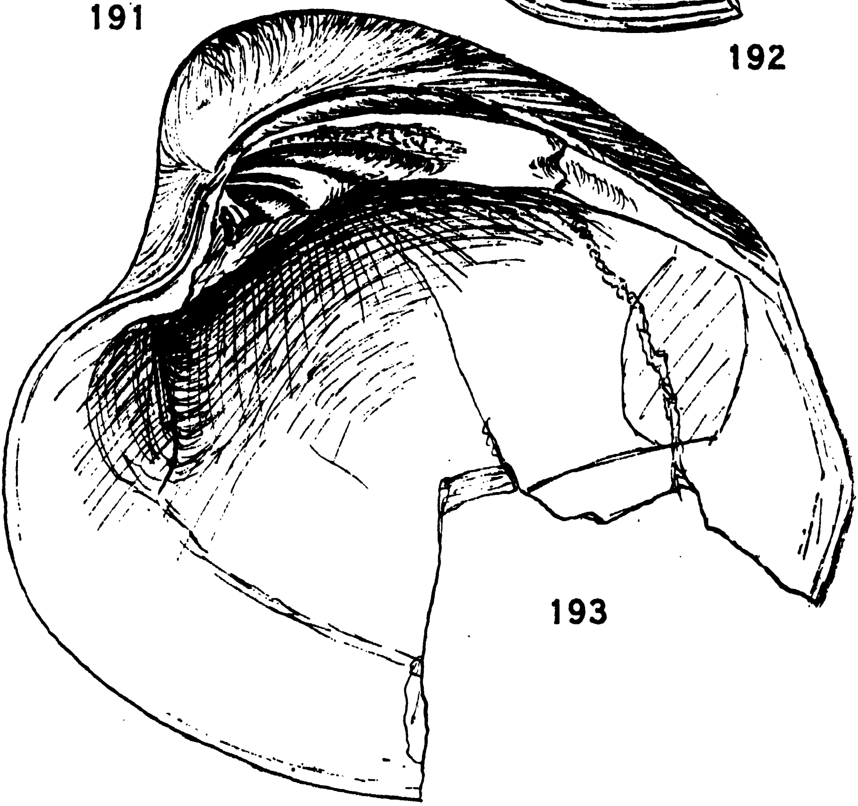
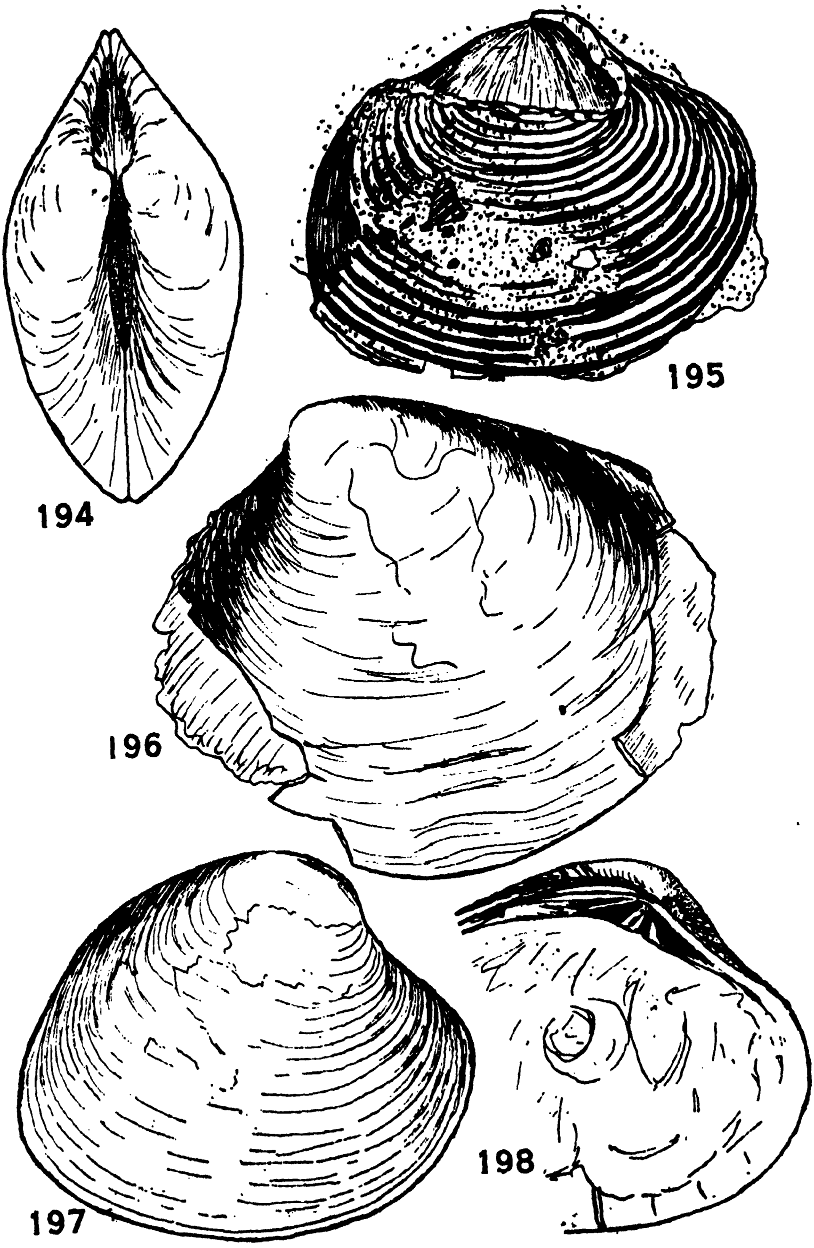


193

FIGS. 188, 189, 190.—*Irona reflexa* (Gray): Recent. × 1.
FIGS. 191, 192.—*Eumarcia* (*Atamarcia*) *crassatelliformis* n.sp.: holotype. × 1.
FIG. 193.—*Eumarcia* (*Atamarcia*) *enysi* (Hutton): topotype. × 1.



FIGS. 194, 197.—*Eumarcia* (*Atamarcia*) *thomsoni* n.sp.: holotype. × 1.
FIG. 195.—*Eumarcia* (*Atamarcia*) *benhami* n. mut.: holotype. × 1.
FIG. 196.—*Eumarcia altilunula* n.sp.: holotype. × 1.
FIG. 198.—*Eumarcia* (*Atamarcia*) *benhami* n. mut.: Waipipi. × 1.

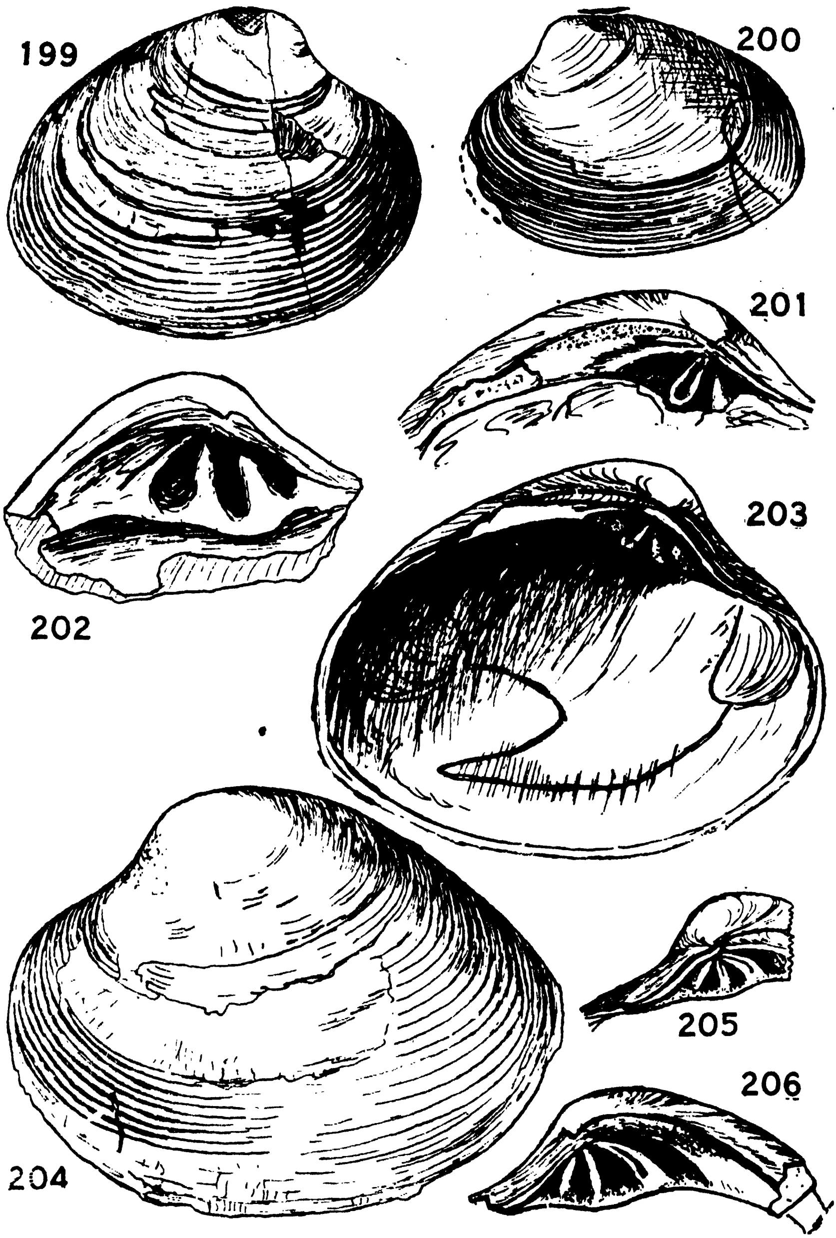
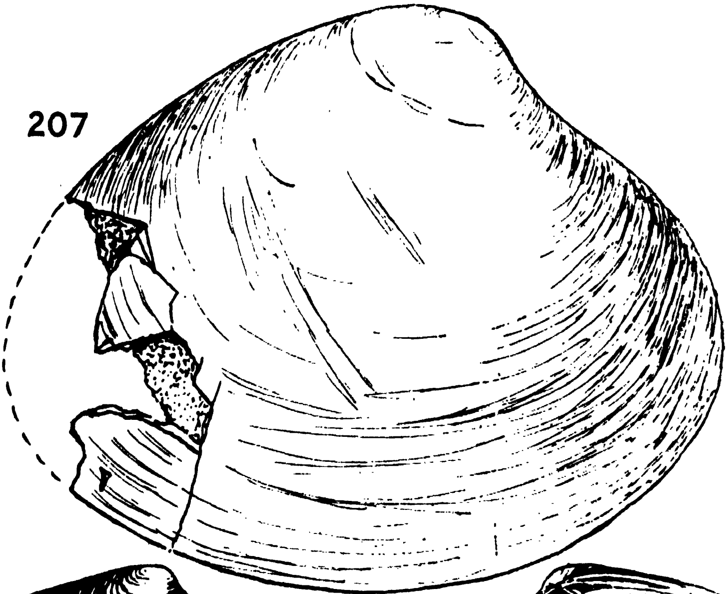
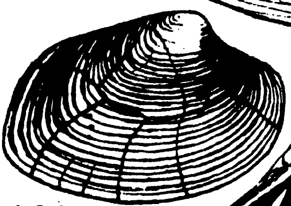


FIG. 199.—*Eumarcia* (*Atamarcia*) *curta* (Hutton): Target Gully. × 1.
FIGS. 200, 205.—*Eumarcia* (*Atamarcia*) *sulcifera* n.sp.: paratypes. × 1.
FIGS. 201, 204.—*Eumarcia* (*Atamarcia*) *curta* (Hutton): holotype. × 1.
FIG. 202.—*Eumarcia* (*Atamarcia*) *crassa* n.sp.: paratype. × 1.
FIG. 203.—*Eumarcia* (*Atamarcia*) *sulcifera* n.sp.: holotype. × 1.
FIG. 206.—*Eumarcia* (*Atamarcia*) *curta* (Hutton): topotype. × 1.

207





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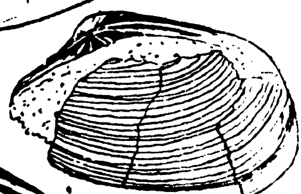

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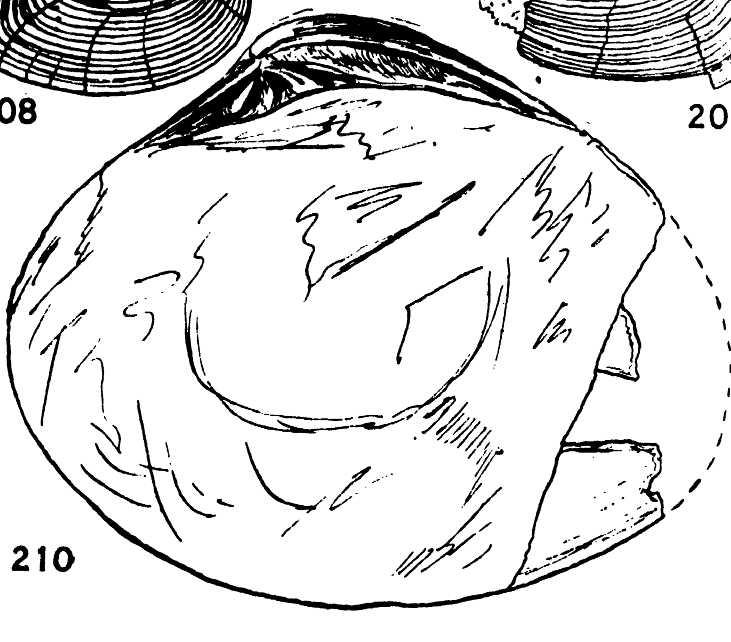
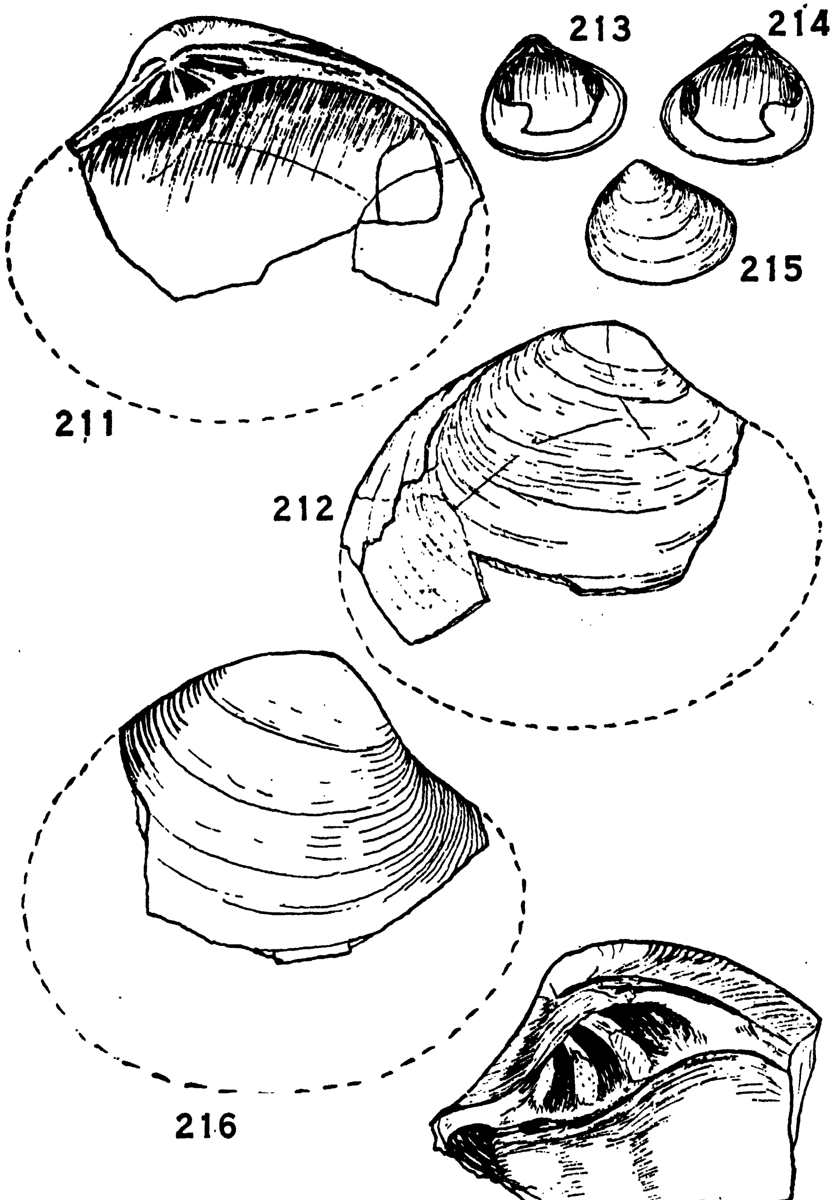


210

FIGS. 207, 210.—*Eumarcia plana* n.sp.: holotype. × 1.
FIGS. 208, 209.—*Paphia* (*Callistotapes*) *finlayi* n.sp.: holotype and paratype. × 1.



FIGS. 211, 212.—*Eumarcia kaawaensis* n.sp.: holotype. × 1.
FIGS. 213, 214, 215.—*Gomphina* (*Gomphinella*) *maorum* Smith: Kaawa. × 4.
FIGS. 216, 217.—*Eumarcia* (*Atamarcia*) *crassa* n.sp.: holotype. × 1.

The Anatomy of *Hemideina thoracica*.

By F. G. MASKELL, B.A., M.Sc., Biological Laboratory, Victoria University College, Wellington, N.Z.

[*Read before the Wellington Philosophical Society, 28th October, 1925; received by Editor, 31st December, 1925; issued separately, 17th February, 1927.*

PLATES 55, 56.

Hemideina thoracica White.

Deinacrida thoracica White, *Voy.* "*Erebus & Terror*," vol. 2, Insects, pl. 5, f. 2, 1846. *Deinacrida megacephala* Buller, *Zoologist*, vol. 2, p. 850, 1867; *Trans. N.Z. Inst.*; vol. 3, p. 34, 1870. *Hemideina thoracica* Walker, *Cat. Derm. Salt. Br. Mus.*, part 1, p. 161, 1869: Butler, *Voy.* "*Erebus & Terror*," vol. 2, Insects, p. 25, 1874. *Deinacrida ligata* Brunner, *Verh. zool-bot. Ges., Wien*, vol. 38, 1888. *Deinacrida megacephala* Hudson, *Man. N.Z. Ento.*, 1892. *Hemideina megacephala* Hutton, *Trans. N.Z. Inst.*, vol. 29, 1897. *Hemideina thoracica* Kirby, *Syn. Cat. Orthoptera Br. Mus.*, vol. 2, p. 115, 1906.

INTRODUCTION.

Hemideina thoracica is a member of the family Stenopelmatidae, tribe Locustidae, order Orthoptera. The Stenopelmatidae are characterized by the following points: long maxillary palpi; compressed tarsi, the first and second joints of which are without lateral appendages, mostly provided with pulvilli; fore-tibiae often with foramina, above with apical spines on each margin; hind-tibiae above with single, below with two apical spines on both margins. The family Stenopelmatidae is divided into two sub-families (1) the Anastostominae, or those provided with pulvilli on the lower surfaces of the tarsi, to which sub-family *Hemideina* belongs, and (2) the Dolichopodinae, or those without any pulvilli. The Anostostominae are further subdivided according to the presence or absence of auditory pits (foramina) on the fore-tibiae. Auditory pits (foramina) are present in *Hemideina*.

According to Tepper, 1892, the Stenopelmatidae are represented in all continents, being best developed in Africa and North America, the Australian region furnishing only a moderate variety. The family contains thirty-eight genera and ninety-four species. Of these, eleven genera and eighteen species are found only in Australia and Polynesia. *Hemideina* is restricted to Australia and New Zealand, but, according to Brunner (quoted by Hutton, 1896), occurs also on Lord Howe Island.

The New Zealand members of the Stenopelmatidae are commonly known by their Maori name of Weta. They are nocturnal insects and live in burrows, made in trees by other insects which they enlarge.

At night they can be heard making their characteristic sound, which resembles that of a match being scratched on the roughened surface of a match box. Both sexes possess "ears" and stridulating organs, so no doubt they call to one another. They also make this sound when irritated or annoyed. The hind legs are raised high above the body, the insect standing firmly on the first and second pairs of legs, and then the hind legs are brought smartly down, rubbing against the file on the abdomen and thus producing the sound. Their food appears to consist chiefly of wood and leaves. They will eat apples and sugar, and they are sometimes cannibalistic, eating one another, when the ventral surface of the abdomen is the part usually attacked. Parasites which prey upon the weta, include mites, which are found upon the softer parts of the exoskeleton, and Nematodes and Gregarines which occur in the mesenteron. Wetas may be found in rangiora *(Brachyglottis rangiora)*, tea-tree *(Leptospermum)*, mahoe *(Melicytus)*, beech *(Nothofagus)* kawakawa *(Macropiper)*, and others. They are often found in dead wood and under loose bark. Certain of the wetas are cave-inhabitating,—not, however, *Hemideina*.

I wish to express my thanks for assistance and advice to Professor Kirk and to Mr. David Miller, Government Entomologist.

SKELETAL SYSTEM.

The Head-capsule. (Fig. 4). The head capsule is arched above and flat before. A median white line extends over the epicranium nearly to the level of the antennae, where it forks, the arms of the

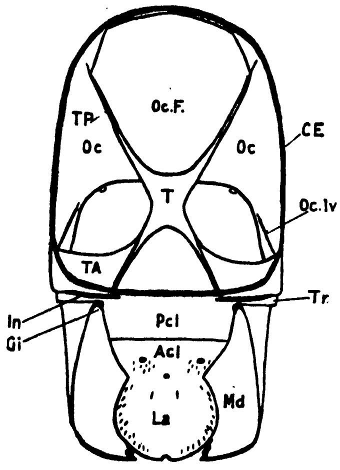


Fig. 4.—Head-capsule viewed from before with front and epicranium removed to expose tentorium.

Acl and Pcl, ante-and post-clypeus; CE, cut edge of capsule; Gi, articulation of ginglymus; In, mouth of invagination forming anterior tentorial arm; La, labrum; Md, mandible; Oc, occiput; Oc.F., occipital foramen; Oc.Iv., invagination on occiput extending dorsad from acetabulum; T.A., and TP, ant. and post. arms of tentorium; T, body of tentorium; Tr., trochantin of mandible.

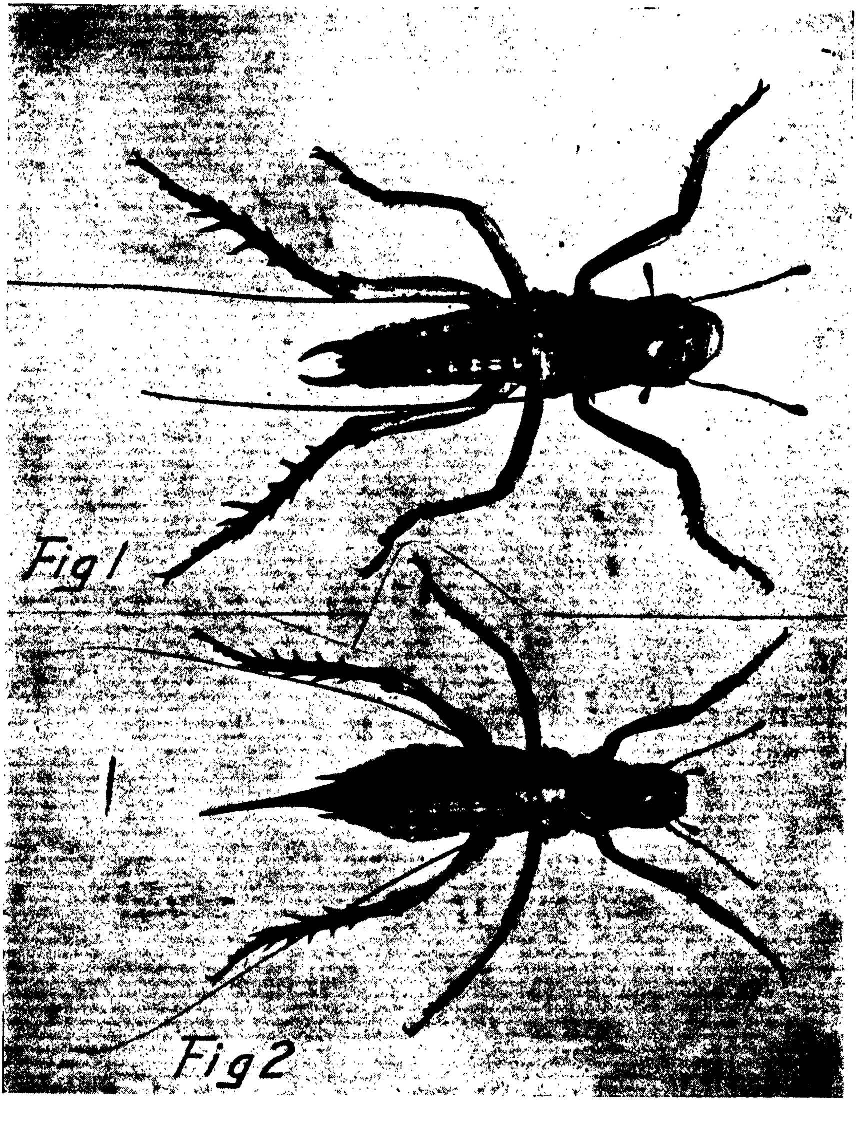


Photo: W. D. Reid.

FIG. 1.—*H. thoracica*, male. × ½.
FIG. 2.—*H. thoracica*, female. × ½.

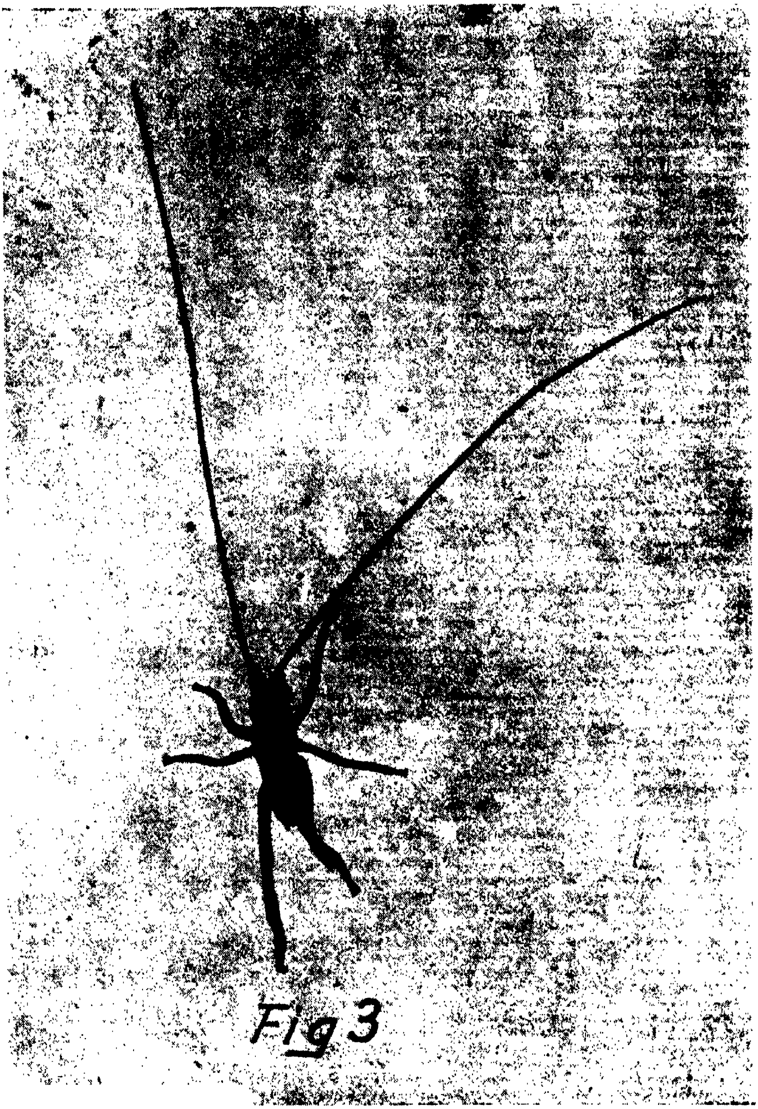


Photo: *Harvey Drake.*

FIG. 3.—*H. thoracica*, first instar.

fork being very short and diverging only slightly. This inverted Y-shaped suture must represent the epicranial suture of other orthopterous insects (e.g. *Blatta)*, but in this case the anterior arms are very much reduced and evanescent (Fig. 25). The anterior arms are on a ridge and between them is a small elongate slightly-depressed area. The ocelli are frequently wanting in the Locustidae. They are represented in*Hemideina* by minute pale coloured circular areas. The lateral ocelli are situated one to the outside of each anterior arm of the epicranial suture. Below these, between the antennae and carried on a projection of the front, is the median ocellus. The compound eyes are pear-shaped. Each is surrounded by a chitinous ring, the ocular sclerite, which is more prominent on the median than on the lateral aspect. There is a small white area at the dorsal end of each eye. The antennae are situated to the inner side of and partly below the compound eyes. At the base of each antenna is a chitinous ring, the antennal sclerite, most prominent on the median aspect. The basal joint of each antenna articulates with a laterally-placed process on the antennal sclerite and is connected all round to the antennal sclerite by a membraneous area. The basal joint is long and cylindrical, the second shorter, the third longer than the second but shorter than the first, and the remainder small. The antennae themselves are as long as and longer than the body.

The front is limited distally by the invaginations forming the anterior arms of the tentorium, laterally by a ridge extending on each side from the base of the compound eye to the above-mentioned invagination and directed slightly outwards, while proximally a median projection of the front extending a short distance between the antennae bears the median ocellus. In the male, the lateral ridges (frontal ridges of Hutton) are rugose and blackened. In the male there is also, on the front, a pair of depressions, one to the inner side of each lateral ridge. The clypeus is separated from the front by the above-mentioned invaginations on each side, but for about the median third of its breadth is continuous with the front, the suture being obsolete. The clypeus is divided transversely into post-clypeus and ante-clypeus. On each side the post-clypeus is confluent with the trochantin of the mandible. At the junction on each side of trochantin and post-clypeus is a concave process for articulation with the ginglymus of the mandible. The ante-clypeus is white and membraneous and has two small chitinous plates in a transverse line. It can be withdrawn under the post-clypeus, thus raising the labrum which it carries. The gena forms the side-wall of the capsule. It is limited from the front by the lateral ridge of the front, and from the trochantin of the mandible by the invagination forming the anterior arm of the tentorium. No sutures separate it from the epicranial or occipital regions. The posterior surface of the capsule is the occipital region, adjoining and enclosing the occipital foramen. On each side the occiput carries an acetabulum in which the condyle of the mandible works. From this acetabulum, an invagination or apodeme extends dorsally along the occiput for a short distance. Surrounding the occipital foramen on each side is a rim, with whose ventral end the cardo of the first maxilla articulates. At about half its length

the rim is divided by an invagination. Between this rim and the occipital wall is an invagination to form the posterior arm of the tentorium. According to Comstock and Cochi (1902) this rim would represent the posterior sclerite (epimeron) of the maxillary pleurite, the anterior sclerite (episternum) being absent here. The tentorium or internal skeleton of the head is formed by an anterior and a posterior pair of arms, which meet and fuse, forming a central plate, the body of the tentorium. The arms are formed as invaginations of the body-wall. The mouths of the invaginations forming the anterior arms can be well seen in *Hemideina.* Each is a transverse slit extending a short distance between front and post-clypeus on the anterior surface of the head, and continued on to the lateral surface where it separates the gena from the trochantin of the mandible. As the mouth has such an extent, an anterior arm is at first wide and fan like, but soon narrows. The invaginations to form the posterior arms are smaller. The mouth of each is situated above the cardo of the first maxilla between the rim at the lateral margin of the occipital foramen and the occiput. Anterior and posterior arms meet, forming a narrow plate, the body of the tentorium, which forms the lower margin of the occipital foramen. Between this structure and the margin of the submentum is a space through which the nerve cord passes.

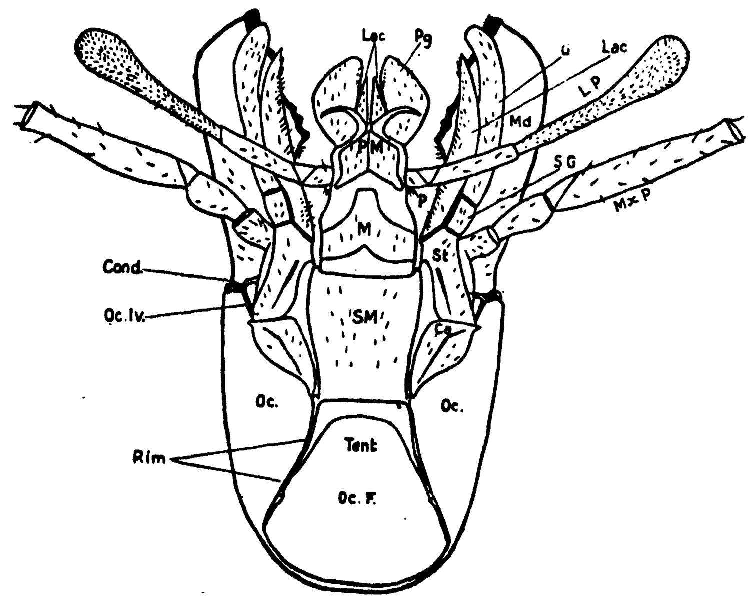


FIG. 5.—Head of male viewed from behind to show mouth parts. Ca., cardo; Cond., condyle of mandible; G, galea; Lac. lacinia; L.P., labial palp; M., mentum; Md, mandible;. Mx.P., maxilliary palp; Oc., occiput; Oc.F., occipital foramen; Oc.Iv., invagination extending dorsad from acetabulum; P., palpifer of labial palp.; Pg., paraglossa; P.M., Prementum; Rim., rim at side of occipital foramen; S.G., sub-galea; S.M., sub-mentum; St., stipes; Tent, tentorium.

Mouth parts. (Fig. 5.) The labrum is carried by the ante-clypeus. It is ovate and its distal margin is notched in the middle line. Its under-surface has a median groove and on each side of the groove is thickly clothed with hairs, nearly all of which are directed towards the groove. The under-surfaces of the labrum and clypeus constitute the epipharynx. At the level of the clypeolabral suture the epipharynx carries a transverse sclerite, with which is connected on each side a small chitinous framework. The under surface of the ante-clypeus is less thickly clothed with hairs and has a median groove, which is separated from that of the under surface of the labrum by the transverse sclerite mentioned.

The paired mandibles are stout and strongly chitinized. In the male they are immense, and the size of the head-capsule is correspondingly enlarged to provide attachment and room for the muscles working them. Thus results the often grotesque appearance of the male, the size of the head being out of all proportion to the rest of the body. A mandible in cross-section is roughly triangular, presenting anterior, external (lateral), and posterior surfaces, and an internal edge whose distal half is toothed. At the apex is a bifid tooth, followed by a single tooth, this followed by a tooth with three cusps. The proximal half of the internal edge carries a number of hairs. Proximally there is a blunt projection on the posterior surface of the mandible. In conjunction with its fellow, it forms a crushing or grinding apparatus for the food. The abductor muscle is inserted on a small chitinous process arising from the proximal margin of the external (lateral) surface, the adductor on a large chitinous process arising from the proximal end of the internal ridge. Between mandible and gena is a small transverse sclerite, the trochantin of the mandible, limited from the gena by the invagination forming an anterior arm of the tentorium. The trochantin of the mandible is continuous with the post-clypeus. The mandible articulates with the head-capsule by an anterior ginglymus and a posterior condyle. The ginglymus articulates with a concave process situated at the point where post-clypeus and mandibular trochantin merge into one another. The condyle articulates with an acetabulum on the ventral margin of the occiput. Behind the mandibles are the paired maxillae. The basal part of each maxilla consists of cardo and stipes. The cardo is a roughly-triangular plate, transversely placed. It articulates with the end of the rim, which bounds the lateral margin of the occipital foramen. The stipes is oblong in shape and vertically placed. Externally the stipes carries the five-segmented maxillary palp. The first two segments are short, the last three long and the last club-shaped. No palpifer is present. Internally the stipes carries the lacinia and the galea. At the tip of the lacinia is a befid spine, and just below this is a movable or articulated spine. The internal surface of the lacinia has numerous hairs. The galea is two-jointed, the proximal joint or sub-galea being short and slightly swollen, the distal joint elongated and provided at its tip with an indentation for the tip of the lacinia to rest in.

Behind the first maxillae are the fused second maxillae, constituting the labium. The sub-mentum is large and articulates also with

the ends of the rims mentioned. It articulates with a smaller mentum. Before the mentum is a still smaller pre-mentum, deeply cleft in the middle line. On each side of the pre-mentum is a palifer, which has the form of a ring incomplete ventrally. Each palifer carries a three-segmented labial palp, the last segment of which is club-shaped. Before the pre-mentum are the paired laciniae, small cone-shaped bodies, and the paired paraglossae, larger and thicker. That portion of the upper surface of the labium, which lies over the sub-mentum and mentum, is greatly swollen, and is produced forwards into a lobe which lies above the paraglossae and lacinae. This conspicuous

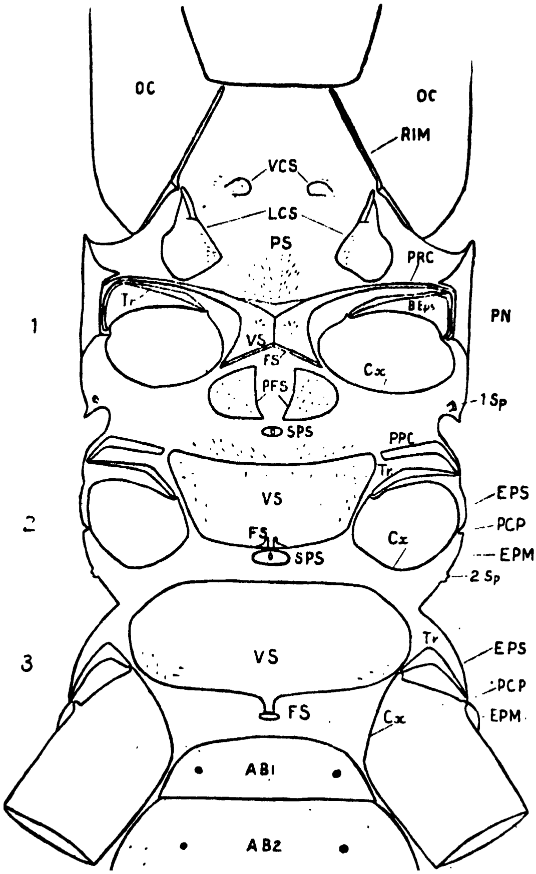


FIG. 6.—Ventral view of cervical and thoracic regions.
1, 2, 3, Pro., Meso., and Meta-thorax; AB. 1 and 2, first and second abd. sterna; B.Eps., base overgrown episternum of prothorax; Cx., Coxa; EPM., epimeron; EPS., episternum; F.S., furcasternite; LCS., lat. cerv. sclerites; Oc., occiput; PCP., pleural coxal process; PN., pronotum; P.S., prosternite; PRC., precoxale; PFS., postfurcasternite; Rim., rim at margin occipital foramen; Sp. 1 and 2 thor. spiracles; SPS, spinasternite; Tr., trochantin; VCS., vent. cerv. sclerites? VS., verasternite.

structure is the hypopharynx. It is soft and spongy, and on each side is strengthened by a chitinous framework. Beneath the forwardly produced lobe is the opening of the salivary duct.

There are two pairs of lateral cervical sclerites (Fig. 6). The anterior and smaller sclerite of a pair is articulated to the rim, forming the lateral margin of the occipital foramen, at the point where the rim is divided transversely into two by a slight invagination. The posterior and larger sclerite is separated from the anterior by a transverse invagination or apodeme. In the ventral surface of the neck are a pair of faintly chitinized small circular patches, forming a transverse row. These may represent ventral cervical sclerites.

Prothorax. (Fig. 6.) The pronotum is very broad from side to side and overlaps the insertions of the legs. Beneath its anterior margin the neck and posterior portion of the head can be withdrawn. The first thoracic spiracles are situated below its postero-lateral margins. According to Martin (1916) the sternum of Insects consists of five subdivisions. The prosternum of *Hemideina* appears to agree with Martin's typical sternum. Anteriorly is a small faintly chitinized area—probably the prosternite. Immediately behind this is the verasternite. At each anterior corner this is produced into a long arm, directed forwardly and laterally. Each arm appears to end just below the antero-lateral margin of the pronotum, but here it is really continuous with the episternum, which as usual in the propleural region of Orthoptera has been overgrown by the pronotum. These arms, then, connecting verasternite and episterna are the precoxal bridges or precoxales. The furcasternite is fused with the verasternite, but a transverse constriction is evident between them. This sternite bears the furca, which consists of two upright processes, each terminating in a thin forwardly directed plate. There is no postcoxale. The postfurcasternite is divided into two halves by a longitudinal non-chitinized area of membrane. The spinasternite is

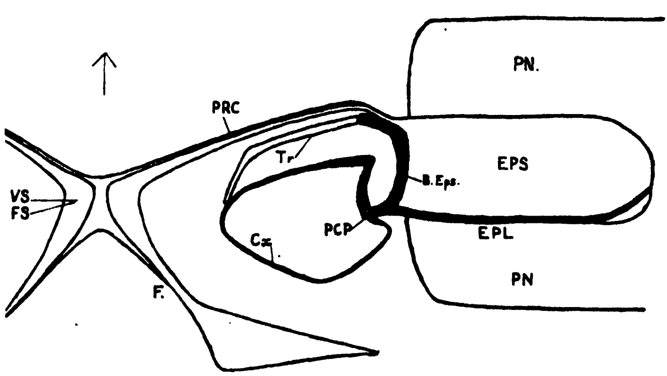


FIG. 7.—Ventral and lateral region of prothorax seen from inside. B.Eps., base episternum; Cx., coxa; EPS., episternum; EPL., entopleural ridge; F, arm of furca; FS., furcasternite; PN., pronotum; PRC., precoxale; PCP, pleural Coxal process; Tr., trochantin; VS., verasternite.

small and oval, and bears the single median spina. Du Porte (1919) states that in Orthoptera the pro-pleural regions are not crowded out but are overgrown by the pronotum, and that overgrown propleura are general throughout Orthoptera (Fig. 7). He figures the propleura of various Orthoptera, including those of three Locustids. A very small portion of the episternum can be seen externally below the lateral margin of the pronotum in *Hemideina*. Within and just below the pronotum are two lateral flat plates, each extending from just below the lateral margin of the pronotum to about half way up to the mid-dorsal line. The anterior margin of each is slightly inflected and parallel with the posterior margin. The dorsal margin is rounded. The width of each plate is about one third that of the pronotum. Along the posterior margin of each plate is a thickening, which at its ventral end articulates with the coxa. The ventral margin of each plate is also thickened and the anterior end of this thickened ventral margin is curved inwards and articulates with the trochantin. This flat plate is really hollow, i.e. it is a flattened bag with sides closely apposed and opening by a mouth just below the lateral pronotal margin. In a softened skeleton a needle can be passed through the mouth into the bag. These structures then result from the overgrowth of the pronotum over the propleura. Each bag may be regarded as having two closely apposed sides, an outer and an inner. The inner side represents the episternum, its thickened posterior margin the entopleural ridge or pleural suture, the ventral articulation of this pleural suture with the coxa the pleural coxal process, while the epimeron is absent or represented by a minute portion of the plate posterior to the entopleural ridge at its dorsal end. In the Locustids described by Du Porte, conditions are very similar, the epimera being very reduced, while the episterna are large.

The outer side of the bag results, presumably, from overgrowth of the pronotum over the propleuron. Moreover this outer side is continuous with the pronotum. For diagrammatic clearness we may compare the crayfish thorax in transverse section. The gill-chamber would represent the cavity of the bag, the thoracic side-wall the pleuron (episternum here), the branchiostegite the overgrown pronotum. The bag-like structure is a natural consequence of the overgrowth. The trochantin, a small triangular sclerite, articulates with the coxa at the middle of the latter's anterior margin and also with the anterior end of the thickened ventral margin of the episternum.

Mesothorax. (Fig. 6.) The mesonotum is broad from side to side, but not so broad as the pronotum. Its anterior margin is inflected and overlapped by the pronotum. In the mesosternum only three sternites can be made out. Verasternite and furcasternite are fused, forming one large plate whose posterior margin carries the medifurca. Extending from the antero-lateral margin of this sclerite to the base of the episternum is on each side a small transverse sclerite, probably the precoxale. It is separated by membrane from both sternum and episternum. The medifurca consists of two diverging arms with expanded extremities, each of which articulates with the pleural arm of the pleural suture of its side. Immediately behind fused verasternite and furcasternite is the small spinasternite carry-

ing the T-shaped spina. The mesopleura consist each of an anterior episternum and a posterior epimeron, separated by the pleural suture, which is not quite vertical but directed obliquely backwards. The pleural suture projects inwards as the pleural ridge or entopleuron. Its ventral end articulates with the coxa as the pleural coxal process, just above this is the prominent pleural arm or process which rests against or articulates with an arm of the medifurca. The trochantin, a transversely placed triangular sclerite, articulates with a small process on the antero-mesal margin of the coxa, while at its other end it abuts against the base of the episternum. The second thoracic spiracle is situated below and slightly behind the epimeron.

Metathorax: The metanotum is overlapped anteriorly by the mesonotum. The metasternum consists of a large verasternite to the caudal margin of which the small furcasternite is fused. The metafurca consists of a median basal process giving off two laterally diverging processes. Each of these at its extremity bears three processes, the middle one of which is large and articulates with the pleural arm of the pleural suture. There is no separate spina. Episternum and epimeron are present on each side separated by the oblique pleural suture, as in the mesothorax. Pleural arm for articulation with the metafurca and pleural coxal process are present. In both meso-and meta-thorax the pleural suture runs from beneath the antero-lateral corner of the meso- or meta-notum, as the case may be, obliquely downwards and backwards to the pleural coxal process. The trochantin articulates with a process on the antero-mesal margin of the coxa and extends from this process to the base of the episternum.

Legs. The legs consist of the usual joints—coxa, trochanter, femur, tibia, and tarsus. The tarsus is four-jointed, the proximal segment or basitarsus is longer than the next two and carries two euplantulae or pads. The next two segments are short, each carrying a pad. The distitarsus is long, is provided with a median, elongated pad, and carries a pair of terminal ungues or claws. Ventrally, between ungues and distitarsus is a plate, the unguitractor, which retracts the claws when it itself is pulled back by a tendon. In the prothoracic legs the coxa bears a large outwardly-directed spine. Crampton (1923) states, "The trochanter articulates with the coxa but does not articulate with the femur in any insect I have examined, and it is quite possible that the trochanter may be a constricted off portion of the femur." In the metathoracic legs of *Hemideina* the trochanter is firmly attached to the femur, there being no articulation between them. But in the prothoracic and mesothoracic legs there is a small but distinct articulation between trochanter and femur. In the prothoracic tibiae are the paired auditory organs. On the anterior and posterior surface of each tibia is a depressed oval area, the tympanum. On the posterior surface of each metathoracic femur, near the trochanter, is an area bearing numerous minute spines. When the hind-legs are raised and brought down against the side of the body, the spiny area on the femur rubs against a file on the second abdominal segment, the spiny area and the file thus forming a stridulating organ. The disposition of the spines on the legs is given by Hutton (1896) in his description of the species.

Abdomen. The terga cover the dorsal and lateral aspects of the abdomen. They are connected to the sterna by membraneous areas in which are the spiracles, and also small faintly chitinized plates representing lateral elements. The first abdominal sternum is small, and is separated on each side by the insertion of the metathoracic leg from its tergum. The second abdominal tergum bears on each side the file for the stridulating organ. A single sur-anal and paired par-anal plates surround the anus. They are large and distinct.

In the abdomen of the male there are ten distinct terga. Between the tenth tergum and the par-anal plate of each side, is a cercus, consisting of a small basal segment (basipodite) and a long cigar-shaped segment. There are nine sterna. The ninth sternum forms the hypandrium. It is large, undivided and bears a pair of styli on its caudal margin. The male genitalia will be discussed under the reproductive system.

In the female there are also ten terga, and a pair of cerci, each cercus consisting of two segments, as in the male. There are eight sterna, the eighth forming the sub-genital plate.

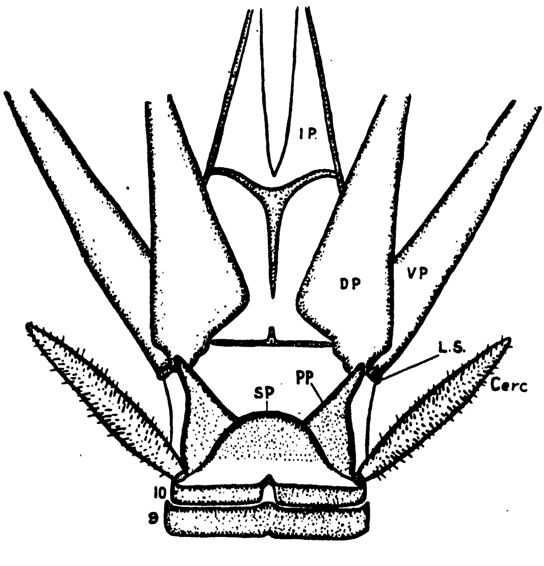


FIG. 8.—Dorsal view of ovispositor with parts separated. Cerc., Cercus with basipodite at base; DP., member of dorsal pair; IP., member of inner pair; VP., member of ventral pair; LS., lat. sclerite; PP., par-anal plate; SP., sur.-anal plate; 9 and 10, ninth and tenth abd. terga.

The ovipositor (Fig. 8) is long and slightly curved. It is composed of six pieces in three pairs,—a dorsal pair, a ventral pair and an inner pair, (1) Between the members of the dorsal pair, near their bases, a dorsal transverse bar extends, and this bar has a small backwardly-directed median process. At the base of each member of this pair is a small sclerite situated laterally. This sclerite appears to

belong to the ninth abdominal segment. Ventrally each member is connected to its fellow by a transverse bar with which the members of the inner pair are also connected. (2) The members of the ventral pair articulate with the small lateral sclerites of the ninth abdominal segment (?) already mentioned. (3) The inner pair is the smallest. Its members are connected by a dorsal transverse hoop, which has a forwardly-directed median process. Their bases are connected to a ventral transverse bar, to which the members of the dorsal pair are also connected as mentioned above.

The bases of the dorsal and inner pairs are connected together for some distance and those of the inner pair much swollen.

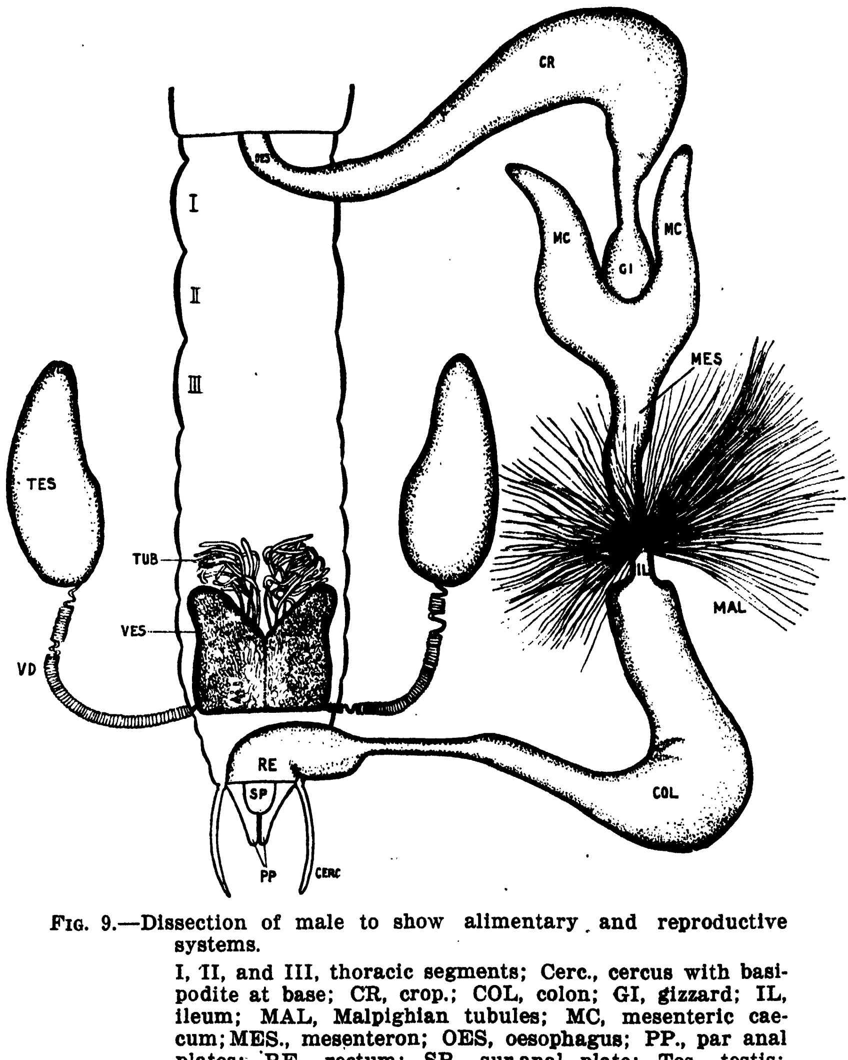


FIG. 9.—Dissection of male to show alimentary and reproductive systems.

I, II, and III, thoracic segments; Cerc., cercus with basipodite at base; CR, crop.; COL, colon; GI, gizzard; IL, ileum; MAL, Malpighian tubules; MC, mesenteric caecum; MES., mesenteron; OES, oesophagus; PP., par anal plates; RE., rectum; SP., sur-anal plate; Tes., testis; TUB., larger tubules of vesicula; Ves., vesicula covered by smaller tubules; VD., vas deferens.

THE ALIMENTARY SYSTEM.

This system consists of the alimentary canal with its glandular and excretory appendages.

A *The Alimentary Canal.* (Fig. 9.) This is roughly about twice the length of the body. Its divisions and their respective lengths are indicated below.

Oesophagus and crop	2.4 cm.
Gizzard	0.8
Mesenteron	1.5
Ileum	0.4
Colon	2.7
Rectum	1.0
	8.8 cm.
Length of Insect	4.8 cm.

The mouth is bounded above by the labrum, laterally by the mandibles and first maxillae and below by the hypopharynx. It opens into the oesophagus, a narrow tube which first runs upwards and then backwards below the brain and above the tentorial plate, leaving the head by the occipital foramen. The oesophagus swells into the very large crop, which fills the thorax and part of the abdomen. When empty, or only partially full, its surface is thrown into folds. Sections (Fig. 10) show that the wall of the crop consists internally of a thick layer of chitin and in this layer faint stratification-lines are visible. Below this layer of chitin is the chitin-secreting epithelium, resting upon a basement-membrane and with cell-boundaries not clearly defined. There are two muscular coats—an internal coat of longitudinal striated muscle-fibres and an external coat of circular striated muscle-fibres. From this circular muscular layer, muscle-fibres at intervals pass inwards through the longitudinal muscle-bundles and end at the basement-membrane. At its posterior end the

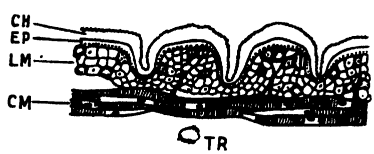


FIG. 10.—T.S. of wall of crop.
CH., chitinous intima; CM., circ. muscle; EP., epithelium; LM., long muscle; TR., trachea.

crop narrows considerably and its internal chitinous lining is raised into six longitudinal folds upon which are small teeth. This narrow passage leads into the gizzard (Fig. 11). Within the gizzard the six folds become large and prominent, each fold bearing about twenty large transverse triangularly-shaped teeth (primary teeth) whose bilobed apices project into the lumen. Each longitudinal row of primary teeth is flanked on either side by a row of smaller or second-

ary teeth, there being, consequently two rows of secondary teeth between any two rows of primary teeth. Between any two adjacent rows of secondary teeth, at the bottoms of the channels formed between them is a longitudinal chitinous ridge not divided into teeth.

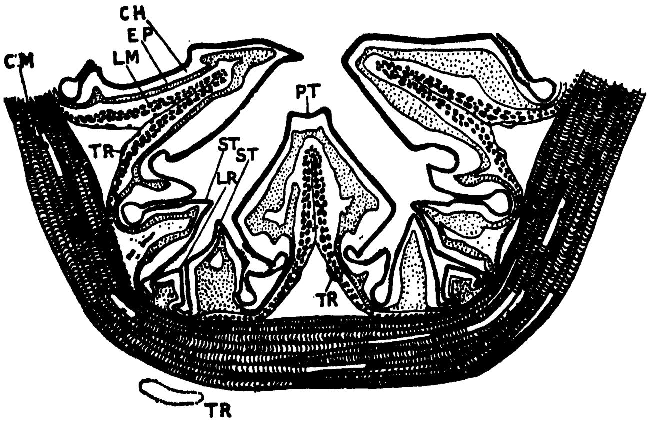


FIG. 11.—T.S. of wall of gizzard.
CH., chitinous layer; CM., circ. muscle; EP., epithelium; LM., long muscles imbedded in connective tissue layer; LR., long, chitinous ridge; PT., primary tooth; ST., secondary tooth; TR., trachea.

Thus in the gizzard there are six rows of primary teeth, twelve rows of secondary teeth, and six ridges not divided into teeth. At the posterior end of the gizzard the teeth suddenly cease, but the six folds are continued on without the teeth and project a very short distance into the mesenteron, when they also abruptly end. The toothless portion of four of these folds is grooved. These four in the natural position of the parts, are the two lateral pairs. The dorsal fold and the ventral fold each bears a flap-valve, which, when not in use, projects backward, parallel to the wall of the mesenteron, but which can be closed. In the closed position, the distal edges of the two flap-valves overlap, and a transverse partition between gizzard and mesenteron is formed. When the valves are closed, the only means of communication between gizzard and mesenteron is by means of the four grooves mentioned above. The chitinous layer is quite flexible between the teeth, but very dense, thick, and dark coloured where it forms the teeth or ridges. It is produced also into many hairs. The teeth are hollow, but their cavities are practically filled by epithelial, connective tissue, and longitudinal muscle-layers. The epithelium, as in the crop, consists of a single layer of cells in which cell-boundaries are hard to distinguish. It lies immediately below the chitinous layer, and in sections often appears many layered, but this is due to the fact that the teeth are frequently cut tangentially. Below the epithelium is a layer of connective tissue, very obvious in the primary teeth. The layer of striped longitudinal muscle projects, like the epithelium, almost to the tip of each primary tooth. It does not enter the secondary teeth or ridges. In the primary teeth the longitudinal

muscle-layer is imbedded in the connective tissue-layer, in which also tracheae ramify. The circular layer of striated muscle is enormously thickened.

The *mesenteron* is produced, at its anterior end, into two forwardly directed caeca, which lie, in the natural position of the parts, one dorsal and one ventral to the gizzard. Two muscular-layers are present in the mesenteric wall—an external layer of longitudinal muscle-fibres and an internal layer of circular muscle-fibres, the latter being striated, the former non-striated. Inside the muscular layer is a layer of connective tissue, and this is not simply a flat layer lying below the epithelium, but from it arise trabeculae which project into

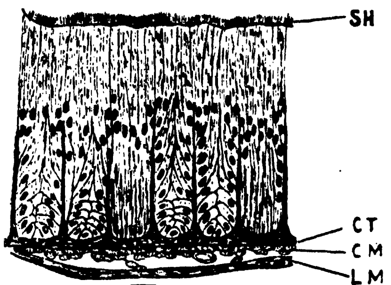


Fig 12

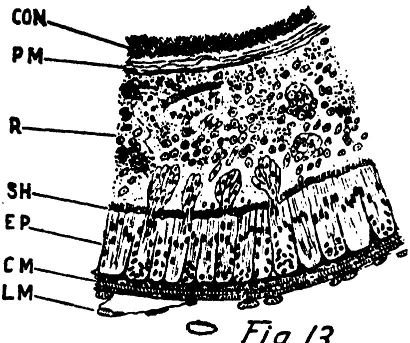


Fig 13

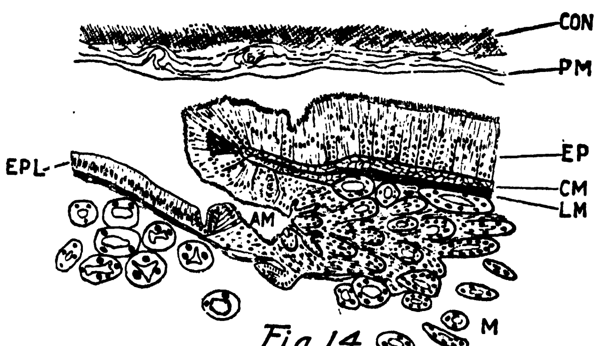


Fig 14

FIG. 12.—Portion of mesenteric wall in L.S. showing six "pits." CT., connective tissue layer with trabeculae; CM., circ. muscle; LM., long muscle; SH., striated hem.

FIG. 13—Portion of mesenteric wall in T.S. probably about end of active phase.
CON., contents in lumen; CM., circ. muscle; EP., epithelium; LM., long muscle; PM., peritrophic membranes; R., region between epithelium and peritrophic membranes occupied by cast off digestive cellules, globules of secretion, etc.; SH., striated hem.

FIG. 14.—LS at junction of midgut and hindgut passing through a urinary bladder or ampulla.
AM., ampulla; CON., food contents in lumen; CM., circ. muscle; EP., mesenteric epithelium; EPL., epithelium of ileum; LM., long muscle; M., malpighian tubules; PM., peritrophic membranes.

the epithelium in an orderly fashion, in such a way that if we could view the connective tissue layer from its internal surface, we should see a honeycombed structure, which we do see in tangential sections of the mesenteric wall. The result of this structure is that in transverse or longitudinal sections we see trabeculae from the connective tissue-layer, projecting at regular intervals into the epithelium (Fig. 12). Each cell of the honeycomb may be referred to as a pit, and a pit in transverse section is generally four or five sided. At the bottom of a pit is a nest of small cells, which multiply by division. Snodgrass (1910) states that in the honey-bee he has not been able to find any of these cells actually in the process of division; and Cameron (1912) writing of the stick-insect says he has not observed any mitotic figures in them. Though not abundant, mitotic figures can be clearly seen in these cells in *Hemideina*. As a result of such division, some of the products of division are pushed up the side-walls of the pits and on to the lips of the pits, where of course they meet cells similarly formed from adjacent pits. From the bottom of the pit to its opening there is an appearance, so to speak, of a succession of cells continually clambering up the side-walls of the pit to the lips. As the diameter of the pits is only small and cells are forced up from below on all sides, these forced-up cells form a coherent layer about and above the mouths of the pits. The free surfaces of these cells, bounding the lumen of the midgut, bear a continuous and obvious striated hem. In a cross section of the midgut (Fig. 13) numerous concentric peritrophic membranes may be seen between the food-contents and the epithelium. According to Imms (1925) "the results of recent research indicate that it (the peritrophic membrane) is continually secreted by a band of deeply-staining gland-like cells situated at the point of junction of the fore and mid intestine (vide Gehuchten, 1890, Vignon, 1901, Bordas and others)." Further on, he says, "In the hive bee (Snodgrass), the larva of Aeschna (Voinov) and certain other insects a peritrophic membrane is described as being formed by the delamination of the inner or free margin of the cells lining the mid intestine." In *Hemideina* the peritrophic membrane is formed as it is in the latter case i.e. from the free surface of the cells lining the mid-intestine. It appears to be formed at the base of the striated hem, i.e. at the surface of the epithelial cells. When the epithelium enters upon a stage of activity, probably the striated hem together with the peritrophic membrane, which in section appears as a fine line between the striated hem and the surfaces of the cells, is cast off. The striated hem seems to disintegrate, while the peritrophic membrane persists as such. Then follows an eruption of the epithelium, the cells about and above the lips of the pits being cast out into the lumen of the midgut, though still separated from the contents by the peritrophic membrane. It is surmised that these cast-off cells are filled with the digestive secretion. The epithelium must then be regenerated from the nests of cells at the bottoms of the pits and a new striated hem formed. However, large areas of these digestive cellules often appear to be cast off at a time when striated hem, peritrophic membrane to-be, and the digestive cellules, can be seen as a coherent mass in the lumen.

At the junction of mid-intestine and hind-intestine are six bladders or ampullae, disposed in a circle around the intestine and opening into it. Into each bladder opens a bunch of Malpighian tubules. The bladders open into the intestine by passages which separate the epithelia of mid-intestine and hind-intestine (Fig. 14).

The *Ileum* (Fig. 15) is short, but is as thick as the mesenteron. The chitinous cuticle is comparatively thin, much thinner, for

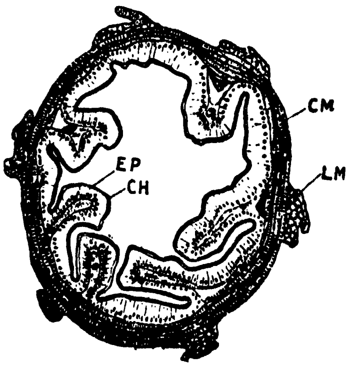


FIG. 15.—T.S. of Ileum.
CH., chitinous intima; EP., epithelium below which is a layer of connective tissue; CM., circ. muscle; LM., long muscle.

instance, than that of the crop. The epithelium, which consists of columnar cells, is often thrown into longitudinal folds, but is capable of being extended. Below the epithelium is a thin layer of connective tissue in which tracheae ramify. There is a circular layer of striated muscle, outside which are six longitudinal bands of striated muscle. From these latter, at intervals, fibres or groups or fibres pierce the circular muscular layer and run for some distance in the longitudinal epithelial folds, ending at the layer of connective tissue, so that in a cross-section three muscular layers may appear, an internal longitudinal, a circular and an external longitudinal.

The *Colon* (Fig. 16) is long, bent upon itself, and about twice the diameter of the ileum. Its internal surface is raised up into numerous leaf-like or tag-like processes. These are large and visible to the naked eye at the anterior end of the colon, but diminish in size towards the posterior end. The processes are restricted to six longitudinal areas, from which they spread out among the contents of the colon. In a freshly-killed insect, if the colon be opened, the processes are not obvious at first, being imbedded in the contents of the colon. But if the colon be soaked in water, the contents can soon be brushed away and the tag-like processes exposed. Each process consists of a double layer of small epithelial cells. Between the six longitudinal areas carrying these processes are six longitudinal bands of columnar epithelial cells continuous with the smaller epithelial cells of the leaf like processes. The cuticle of the epithelium is thin. Below the epithelium is a delicate layer of connective tissue. There is a thin

circular layer of striated muscle and within this appear a few longitudinal bundles. Outside are six longitudinal bundles of muscle fibres as in the ileum.

The *Rectum.* A slight constriction separates the colon from the rectum. In the rectum (Fig. 17) the six longitudinal areas which

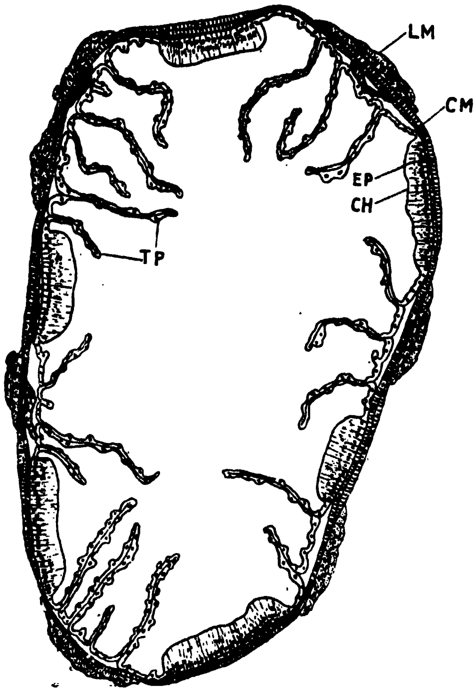


FIG. 16.—T.S. of Colon.
CH., chitinous intima; EP., epithelium; CM., circ. muscle; LM., long muscle; TP., tag-like processes.

in the colon bore the tag-like processes, persist as narrow corrugated areas, the corrugations appearing in cross-section. The cuticula covering the corrugated areas is moderately thick. Between the corrugated areas are to be seen the six longitudinal bands of taller epithelial cells, supporting a comparatively thin cuticula. These bands of taller epithelial cells are more extensive in the rectum than in the colon. They do not offer any appearance of glandular structure, though they agree with the description by Chun of rectal glands in *Locusta viridissima* (quoted by Packard, 1903). Minot has stated that Chun's description is applicable to the Acridiidae he has investigated, and he states that the rectal folds "do not offer the least appearance of gladular structure." In *Hemideina,* beneath the portions of corrugated cuticula, a distinct epithelium is present. This is an answer to the challenge given by the figures of transverse sections of the rectum of the cockroach (Miall and Denny, 1886) and of the stick-insect, *Bacillus Rossii* (Cameron, 1912). In both these cases, the areas

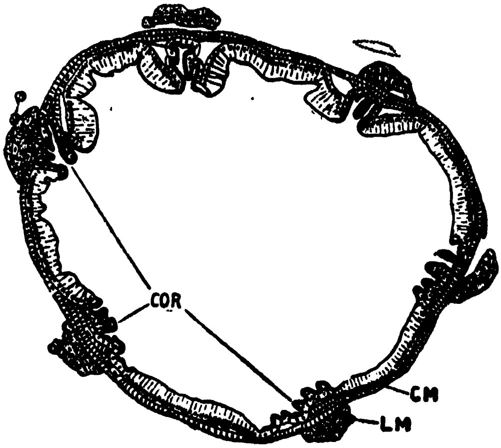


FIG. 17.—T.S. of Rectum.
CM., circ. muscle; COR., corrugated areas, with thicker cuticula; LM., long muscle.

of corrugated cuticula are figured without any underlying epithelium. Miall and Denny state that in these areas the chitinous lining blends with the basement membrane, while Cameron says that between each two bands is a non-epitheliated interspace where the chitinous intima becomes corrugated and is closely applied to the basement membrane. No explanation of this anomaly is offered.

A thin layer of connective tissue is present beneath the epithelium and outside the connective tissue layer is a thin layer of circular striated muscle. Externally the six longitudinal bands, present in the ileum and the colon, are to be found here also. These six longitudinal muscular bands are attached to the body-wall between the ninth and tenth abdominal terga.

B. *Glandular and Excretory Appendages of the Alimentary Canal.*

The *Salivary Glands.* (Fig. 18.) There is one pair of diffuse salivary glands. They lie in the thorax below and at the sides of the crop. Each gland consists of a number of lobules, each lobule provided with a ductule. The ductules on each side unite, forming a main duct and the two main ducts themselves unite into a single duct, which opens to the exterior immediately below the hypopharynx and above the labium. Into the main duct of each gland opens a salivary reservoir. The main ducts and their branches are provided with taenidia, but not the reservoirs.

The *Mesenteric Caeca.* These two caeca lie, as already mentioned, one above and one below the gizzard. The epithelial layer is deeply folded, the folds projecting into the lumen, and both muscular layers are striated, otherwise they resemble the mesenteron. The caeca generally contain a dark brown secretion, which appears to be passed forwards into the crop.

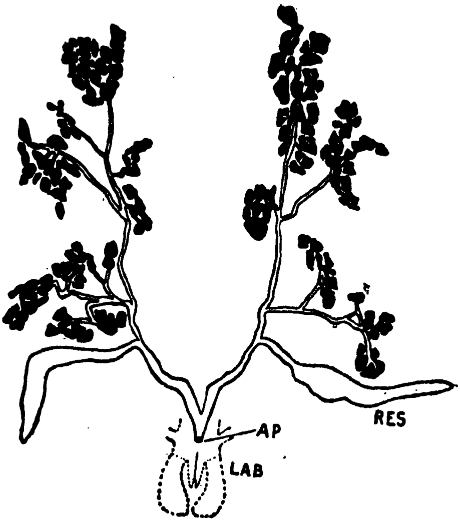
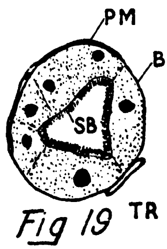


FIG. 18.—Salivary glands.
AP., opening of salivary duct; LAB., labium; RES, reservoir.

Malpighian Tubules. There are about two hundred Malpighian tubules in the weta. They are long thin tubules, arranged in six bunches, each bunch opening into one of the six bladders or ampullae mentioned above. In a just-killed insect dissected in normal saline solution, a slow serpentine movement of the individual tubules is observable. Each tubule is accompanied by a small trachea. In a cross-section of a tubule (Fig. 19) externally is to be seen a delicate



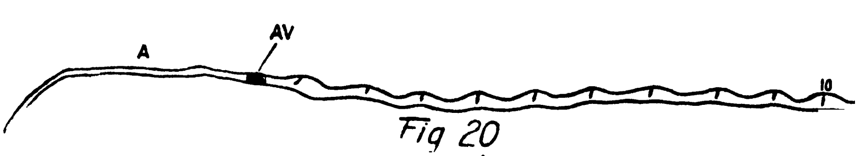


FIG. 19.—T.S. of a Malpighian tubule.
BM., basement membrane; PM., peritoneal membrane; SB., striated border; TR., trachea.

FIG. 20.—The Dorsal vessel, viewed from the side.
A., aorta; AV., aortic valve; 1, 10 and 11, first, tenth and eleventh chambers.

nucleated membrane, the peritoneal membrane, the nuclei being rare and small. Inside this is a layer of large epithelial cells resting upon a basement membrane and with prominent nuclei. The internal margins of these cells, lining the lumen of the tubule, present a striated appearance, which is said by some to be due to the presence of numerous minute pore-canals.

CIRCULATORY SYSTEM.

The dorsal vessel or heart (Fig. 20) is a long delicate tube extending from the posterior end of the abdomen into the prothorax, from whence it is continued as the aorta into the head. The heart contains eleven chambers, marked off from each other by constrictions, and each chamber is provided with a laterally-placed pair of ostia. The eleventh or last chamber is smaller than the others, and its osta terminal and dorsally placed. The ostia appear as vertical slits with lips reflected inwards. They are not situated at the constrictions between chambers as is apparently usual, but at about the centre of the chambers. At the anterior end of the heart is an aortic valve. This consists of about twelve annular fibres close together. The extension forwards of the heart beyond this point constitutes the aorta. It is not chambered, and has no ostia. It bends ventrally, and opens between the paired oesophageal sympathetic ganglia in the head.

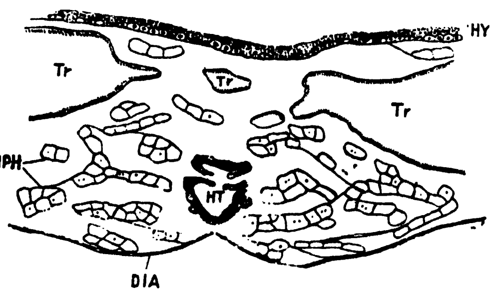


FIG. 21.—T.S., through heart region.
DIA., diaphragm; HY., two-layered hypodermis, resting on basement membrane, chitinous cuticula not shown; HT.. heart, the section passes through a pair of ostia; NPH., nephrocytes; TR., trachea.

The wall of the heart (Fig. 21) consists of a cytoplasmic layer containing nuclei and exhibiting a delicate transverse striation in sections. This layer is bounded internally by a very delicate membrane, and externally by a coarser membrane. Small tracheae are attached to the heart-wall, and the heart itself is suspended in position by delicate threads or filaments passing to the abdominal terga. The pulsating heart may be observed if an insect be decapitated, the dorsal body-wall removed, and pinned down in salt solution.

The heart is enclosed in a space, the pericardial sinus, bounded dorsally by the terga and ventrally by the diaphragm. The latter is a thin transparent nucleated membrane with numerous fine interlacing fibres running in it. Portions of it can be removed and examined, when it is seen to be perforated by numerous apertures,

generally small and oval in shape. Eleven pairs of alary muscles are present. They consist of striated fibres, and members of a pair take their origin dorso-laterally from the terga as narrow bands which then spread out fanwise upon the diaphragm. Within the pericardial sinus, on each side of the heart, is a mass of light-brown tissue. This consists of fairly large cells, not closely packed, often arranged in linear series, and mostly binucleate. The binucleate condition is obvious in fresh cells appropriately examined, though it is, of course, not always so obvious in sections. These are the pericardial cells or nephrocytes, said to have the property of storing up substances of an excretory nature. Above these cells, and above the heart also, are the dorsal tracheae.

Above these tracheae is the hypodermis which is here two-layered and rests upon a basement membrane. The upper layer contains numerous small nuclei, the cell boundaries not being clearly defined, and much pigment. The details of this layer are often obscured by the abundant pigment. The lower layer consists of large cells with large nuclei and abundant granular cytoplasm. They are usually elongated in a transverse direction. A rather similar state of affairs is described and figured by Berlese (1909, p. 470) for Periplaneta.

A few Malpighian tubules penetrate the diaphragm, a portion of their length thus lying in the pericardial sinus. The dorsal tracheae are also contained in the pericardial sinus.

In the thorax a ventral diaphragm is present. It lies above the salivary glands, which generally adhere to its lower surface. Associated with it are some ventral nephrocytes, binucleate as are the dorsal ones. The ventral diaphragm is thin and transparent, and I have been unable to make it out in the abdomen, if it is present. In the ventral region of the abdominal cavity the fat body-layer is very abundant. The blood is colourless and contains nucleated corpuscles. These are of two chief kinds—approximately circular and with granular contents, or spindle-shaped and with comparatively clear protoplasm. To obtain the blood, the best way is to cut off the top of the head. In doing so the aorta is cut and a plentiful supply may be obtained.

NERVOUS SYSTEM.

The brain or cerebral ganglion (Fig. 22) is placed above the oesophagus, the latter resting upon the tentorial plate. It consists of two pear-shaped masses, united above in their broader parts, the stalks diverging below, encircling the oesophagus and tentorial plate as the para-oesophageal connectives and joining the sub-oesophageal ganglion below. From the upper portion of the brain (Protocerebrum) arise three ocellar nerves, one pair and a single median one, each passing to its respective ocellus. Laterally from the protocerebrum also arise the optic nerves. Distally each nerve swells into a ganglion and from this ganglion seven to eight short tracts pass to the compound eye. Below the protocerebrum is the deutocerebrum and from this arise the antennary nerves, each of which is double from its origin, and also a pair of very fine nerves, no doubt the tegumentary nerves. The third division of the brain is the tritocerebrum, but this is not obviously distinct externally. It consists of two

halves, each half lying towards the base of the pear, and thus widely separate from its fellow. The halves are joined, however, by the post-oesophageal commissure, passing below the oesophagus. From the tritocerebrum arise the para-oesophageal connectives which pass

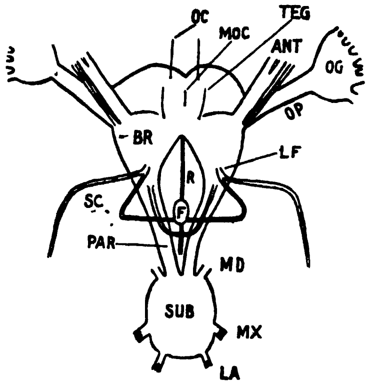


FIG. 22.—Brain and sub-oesophageal ganglion viewed from before. ANT., antennary nerve; BR., brain; F., frontal ganglion; LA., nerve to labium; LF., labro-frontal nerve; MD., nerve to mandible; MX., nerve to maxilla; MOC., median ocellar nerve; OC., ocellar nerves; OG., optic ganglion; OP., optic nerve; PAR., para-oesophageal connective; R., recurrent nerve; SC., post-oes commissure; SUB., sub-oes ganglion; TEG., tegumentary nerves?

to the sub-oesophageal ganglion and also the labro-frontal nerves. Each labro-frontal nerve immediately divides into two, the outer branch passing to the labrum, the inner curving round and joining the frontal ganglion. The sub-oesophageal ganglion lies below the oesophagus and is connected to the brain by the para-oesophageal connectives. From it originate paired nerves supplying mandibles, maxillae, and labium, and also a pair of connectives which pass backwards between submentum and tentorial plate through the neck to the first thoracic ganglion. There are three thoracic and six abdominal ganglia connected as usual by paired longitudinal connectives (Fig. 23). From the sub-oesophageal to the third thoracic ganglion, between any two adjacent ganglia, is an extra pair of connectives, the members of which lie outside the stouter main connectives. From each thoracic ganglion several pairs of nerves arise, one large pair supplying the legs of the corresponding segment. The first three abdominal ganglia are close together, the fourth and fifth further apart, and the fifth and sixth closer again. From the first abdominal ganglion arise two pairs of nerves, from the second to the fifth one pair each, while the sixth is the largest abdominal ganglion and gives off numerous nerves, supplying among others the cerci, the ovipositor in the female and the vesiculae seminales in the male. The visceral or sympathetic nervous-system is well developed. It consists of oesophageal sympathetic and ventral sympathetic systems. In the

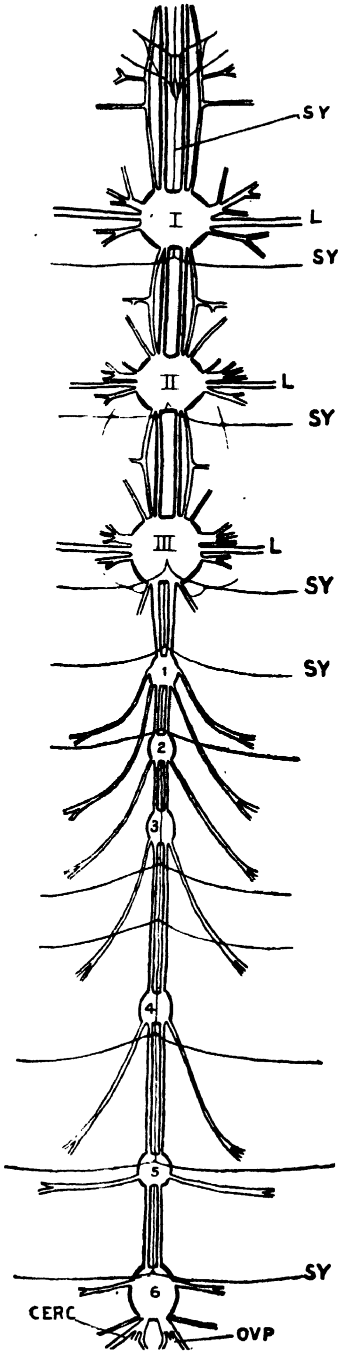


FIG. 23.—Ventral Nerve Cord.
I, II and III., Thoracic ganglia; 1 to 6, abdominal ganglia; CERC., nerve to cercus; L., nerve to leg; OVP., nerve to ovipositor; SY., sympathetic nerves.

oesophageal system (Fig. 24) we note a small frontal ganglion lying on the oesophagus a short distance in front of the brain. From it come off four nerves, anteriorly a frontal nerve to the labrum, laterally a pair of nerves which connect with the trito-cerebrum, and posteriorly a median recurrent nerve which runs back along the oesophagus and below the brain and then swells into a hypocerebral ganglion. The hypocerebral ganglion is hidden from view by a pair of oesophageal ganglia which lie over it. These can be separated, when the hypocerebral ganglion is exposed and is seen to be connected with each oesophageal ganglion. The oesophageal ganglia are also con-

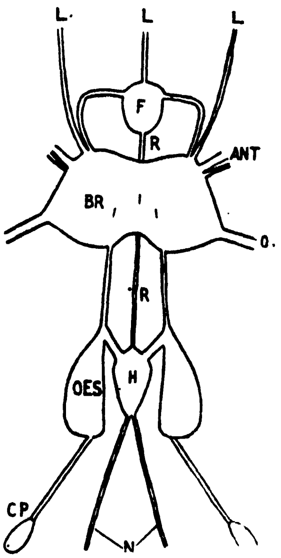


FIG. 24.—Plan of oesophageal sympathetic system viewed from above. BR., brain; ANT., antennary nerve; CP., corpus allatum; F., frontal ganglion; H., hypocerebral ganglion; L., nerves to labrum; N., nerves to stomachic ganglia; OP., optic nerve; OES., oesophageal sympathetic ganglion; R., recurrent nerve.

nected with the brain. From the posterior margin of the hypocerebral ganglion arises a pair of nerves, each member of which runs along the side of the crop, giving off fine branches as it goes, and at the junction of crop and gizzard swells into a ganglion, the stomachic ganglion, from which numerous nerves passing to crop and gizzard arise. Behind each oesophageal ganglion and connected with it by a fine nerve is a small white flattened body, oval in outline, the corpus allatum. According to Imms (1925) the corpora allata, frequently mistaken for posterior oesophageal ganglia, are found in all orders of insects, and are to be regarded as ductless glands which secrete certain substances into the blood.

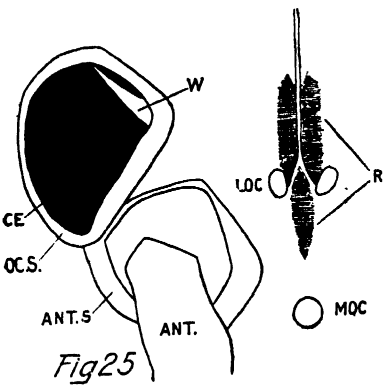
The ventral sympathetic system lies just above the ventral nerve-cord. Its constituent nerves are fine and delicate. Between sub-

oesophageal and first thoracic ganglia runs a median cord, which at the middle of its length is double for a short distance. Each half of this doubled part has a small ganglion from which several nerves arise. From the first thoracic ganglion arise a pair of nerves which run outwards to the first thoracic spiracles. Of the nerves arising from the second and third thoracic ganglia, each swells into a small ganglion and from these ganglia nerves run outwards to the second thoracic and first abdominal spiracles respectively. From the abdominal nerve cord arise seven pairs of sympathetic nerves. Each pair arises from a minute ganglion connected by a median nerve with the abdominal ganglion in front of it.

The sympathetic nerves run outwards and at some distance from the ventral nerve-cord junction with the peripheral nerves from the abdominal ganglia and from this junction branches arise, and by certain of these branches the spiracles are supplied.

THE COMPOUND EYES AND OCELLI.

The compound eyes are situated above and to the outer side of the antennae. Each projects considerably from the surface of the head-capsule, and each is surrounded by a thick chitinous ring, the ocular sclerite (Fig. 25). The eye, viewed from the exterior, looks dark in colour except that at the inner and dorsal corner of each eye is a small white triangular area. When the insect is in a horizontal position, these white areas look upwards towards the sky. The ommatidia below such a white area possess practically no pigment or very little indeed. They are easily distinguishable in a section from the



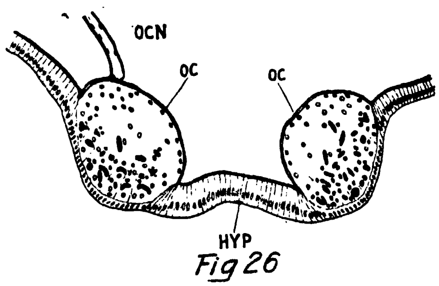


FIG. 25.—Part of head of male viewed from before to show compound eye and ocelli.
ANT., antenna; ANT.S., ant. sclerite; C.E., compound eye; LOC., lat. ocellus; MOC., med. ocellus; OC.S., ocular sclerite; R., ridge upon which epicranial suture divides; W., white area on comp. eye.

FIG. 26.—T.S. through the two lateral ocelli.
HYP., hypodermis; OC., ocellus; OCN., ocellar nerve. The cuticle has been removed, the rhabdoms are black.

remaining ommatidia by their clear appearance. Over this area also the corneal lenses differ from the remainder. The eyes are of the eucone type with the nuclei of the cone-cells located in front of the cone. A corneal lens or facet is slightly biconvex and consists of outer and inner layers of which the outer stains much more deeply than the inner. Below the lens would normally appear the corneagen cells, but these I have been unable to detect. Then appear four cone-cells which secrete the crystalline cone. The nuclei of the cone-cells are obvious, and are placed in front of the cone, while the cone itself shows a division into four constituent parts. The proximal portion of the cone is gripped by the four expanded distal ends of the rhabdom. These four soon unite into a single rod, and this apparently single rod extends to the basement membrane. The rhabdom is surrounded by the retinula cells which have produced it. They contain pigment. Their number was not accurately determined but appears to be seven. Around each ommatidium is a number of accessory pigment-cells, isolating it from its neighbours. The ommatidia rest upon a fenestrate membrane, through which nerve-fibres from the retinula cells pass.

Hutton (1896) in his description of the genus *Hemideina* mentions the ocellus as obsolete. In *H. thoracica* there are, however, three ocelli, and as these all show the typical ocellar structure (retinula cells, rhabdoms, etc.) we may infer that they are all functional. The ocelli are arranged in a triangle (Fig. 25), the two lateral ocelli being situated one on each side of a median ridge upon which the epicranial suture divides, while the median ocellus forms the apex of the triangle. The median ocellus looks forward while the lateral ocelli looks sideways. In section (Fig. 26) the rhabdoms are cut at all angles, and so a very irregular arrangement is presented. Here and there is seen a triradiate rhabdom surrounded by three retinula cells with nuclei. This structure I take to be a cross section, the retinula cells apparently being grouped in threes and producing the triradiate rhabdom. It is difficult to imagine all the structures seen in a section as fitting in with this conception, but it is the only regular arrangement I have been able to observe.

Before each ocellus, the hypodermal cells, in this region normally quite tall, become very short and small.

RESPIRATORY SYSTEM.

Only the briefest account of this system is given. It is remarkable for the number of dilated tracheae which it contains. These all possess taenidia, in shape resemble a straight sausage with ends passing into very narrow tracheal tubes, and may be referred to as tracheal sacs. Nearly all of them are superficially placed i.e. they occur just below the hypodermis and are surrounded by fat-tissue. The distribution of the tracheae and tracheal sacs was studied by an injection method described by Kirk (1924. Ten spiracles are present, two thoracic and eight abdominal, and there are two pairs of main

longitudinal tracheae, a dorsal pair and a ventral pair. It is intended at a later date to give an account of the distribution of the tracheae and the structure of the spiracles.

THE FAT-BODY.

The fat-body consists of a densely white opaque tissue whose interwoven strands form a lace-like pattern. It is very abundant indeed, particularly in the ventral abdominal region, but it occurs in most parts of the body. It is a cellular tissue, the cells being large, nucleated, and four- to five-sided to rounded. In portions of it the cell boundaries appear to have broken down. Probably they do so in older specimens, as is said to be the case in the cockroach.

MALE REPRODUCTIVE SYSTEM (Fig. 9).

The testes are two white bodies lying in the abdomen, one to each side of the alimentary canal. Each is roughly pear-shaped in outline, the broader end being that from which the vas deferens leaves. Each testis is made up of numerous elongated follicles, each follicle with a short efferent duct. The follicles are arranged at the periphery of the testis with their efferent ducts all leading into the central region of the testis, so that in a longitudinal section we see a central region packed with sections of ducts and a peripheral region of sections of follicles. The efferent ducts unite to form a single vas deferens which leaves the testis at its broader end. Each follicle is surrounded by a thin flattened peritoneal layer and this also serves, together with a thin layer of fat-tissue, to bind the various follicles together, so forming a testis. In a section of a follicle at its blind end can be seen several groups of spermatogonia, each group surrounded by a thin sheath or cyst, and along this thin sheath occur here and there cells, the nurse-cells. Such an envelope or cyst of nurse-cells is a spermatocyst. According to Miall and Denny, 1886 (note on p. 176), spermatocysts are peculiar to Insects and Amphibia. According to Berlese, 1909 (p. 924) the two kinds of elements, cyst or nurse-cells and germinative cells (spermatogonia) are differentiated at the blind end of the testicular lobule. Then a number of nurse-cells form a cyst around a number of spermatogonia. Berlese summarises the views of recent observers on the cyst-cell. The following is a free translation—"By Sutton (1900) and Voinov the cyst cell is compared to a primary spermatogonium, by Holmgren to an indifferent syncytium, by Paulmier (1899) and Gross (1904) to connective elements. Korschelt and Heider (1902) derive it from an indifferent initial cell. Finally Henneguy (1904) considers that the cyst cell ought to be homologised with the ovarian epithelial cell."

Passing from the blind end of a follicle towards its efferent duct, the spermatocysts become larger, and their contents are at different stages in the process of spermatogenesis (primary and secondary spermatocysts etc.) until finally near the efferent duct the spermatocysts contain spermatids and spermatozoa. It should be noted here that the spermatids are quite free from one another. But in the vasa deferentia the spermatozoa are not free from one another. On the

contrary they are aggregated together in wisp-like groups or bundles (sperm bundles), and these sperm-bundles in the vas deferens are not enclosed in spermatocysts.

It seems clear from a study of sections that at about the junction of follicle and efferent duct the spermatocyst must break down, and at this time also all the spermatozoa in one spermatocyst become aggregated together to form a sperm-bundle. The sperm-bundles may be studied alive in teased preparations of the testes and vasa deferentia of the male and the spermatheca of the female. The sperm bundle

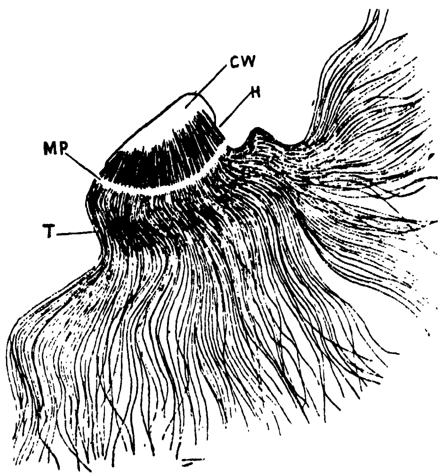


FIG. 27.—A Sperm bundle from a smear preparation.
CW., clear white area; H., heads; MP., middle pieces; T., tails.

(Fig. 27) is flat and asymmetrical and as it swims, rotates on its longitudinal axis. Seen on the flat, three areas are distinguishable in a bundle. The anterior part is a clear white area, convex anteriorly, the convexity, however, being nearer one side than the other, thus producing the asymmetrical appearance. On either side the clear white area is produced into a backwardly directed process. The middle part of the bundle consists of the massed heads of the spermatoza, the heads being inserted into and presumably bound together by the clear white area. Behind the heads is a narrow zone occupied by the middle pieces of the spermatoza, and then follow the tails. The tails are long and work in unison, propelling the bundle forwards. As to the formation of the sperm-bundle, before the spermatocyst breaks down, nurse-cells are seen within the spermatocyst. They perhaps have migrated inwards from the wall. Their nuclei are usually in process of fragmentation, and it seems possible that the cytoplasm of such cell or cells forms the clear white anterior end of the bundle into which the sperm-heads are inserted. The single spermatozoon exhibits an elongate head tapering to a fine point, a short middle piece and a tail about five times the length of the head.

The vasa deferentia are a pair of very closely coiled tubes which lead from the testes to the vesiculae siminales. The wall of the vas consists of externally a peritoneal coat and internally an epithelium lining the lumen.

The vesiculae are paired and the cavity of each is small. Externally a vesicula presents a bushy appearance. This is due to the fact that its surface is covered with very numerous diverticula, the accessory glands or tubules and these are of two kinds. Anteriorly is a bunch of larger tubules which open into the ventral surface of the vesicula, while the remainder of the surface of the vesicula is hidden from view by the very numerous smaller tubules. In sections streams of coagulated secretion can be seen pouring into the vesiculae from these tubules, and each vesicula may contain a mass of this coagulated secretion. In sections passing through the junction of vas deferens and vesicula, sperm-bundles can be seen entering the vesicula from the vas. Sperms are never, so far as I know, found in the tubules. The vesicula is lined by an epithelium continuous with that of the various tubules. Outside the epithelium is a thick layer of muscular tissue, which, of course, the tubules penetrate.

Posteriorly the veciculae unite in a very short passage which immediately opens into the ductus ejaculatorius. The ductus traverses a structure which I shall refer to as the penis. The ductus is lined by chitin, below which is a chitin-secreting epithelium, and outside this is a well-developed muscular layer of striated fibres. Within the ductus was foud on one occasion a mass, viscid in nature, and apparently nearly ready for expulsion. It was hardened (by reagents) and sectioned. It consisted undoubtedly of the secretion derived from the accessory glands or tubules, and within it were numerous sperm-bundles. It was evidently a spermatophore, but how the spermato-

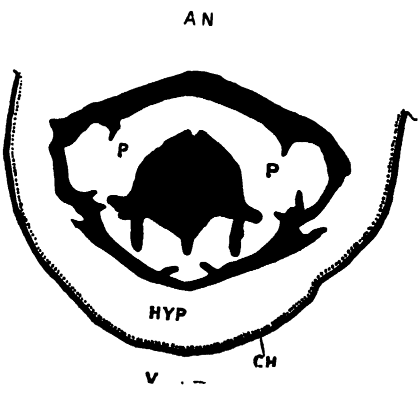


FIG. 28.—T.S. of Penis and adjoining regions.
CH., Chitinous cuticula with underlying hypodermis of hypandrium; HYP., hypandrium (sub-genital plate); P., penis. The cavity within the penis, and the cavity between penis and hypandrium both black. AN., anal region; V., ventral.

phore is transferred to the female I have been unable to observe. It is, however, the means of transferring a number of sperm-bundles to the female.

The sternum of the ninth abdominal segment is enlarged, forming the hypandrium (sub-genital plate). Terminally it bears a pair of small unjointed styli. Above the hypandrium is a large cavity, whose roof is formed partly by the ventral surfaces of the par-anal plates but chiefly by a membranous (i.e. not heavily chitinized) area of integument stretching cephalad from these. Its floor is formed by the upper surface of the hypandrium, also membranous. On each side, the membranous roof and floor meet, forming lateral walls. Posteriorly it opens to the exterior, but from the anterior wall of this cavity a single structure, the penis, projects caudad into the cavity, the membranous roof and floor being, of course, reflected on to the penis (Fig. 28). About the centre of the roof of this cavity are two minute pit-like depressions of the integument, which serve apparently only for the insertion of muscles. At each anterolateral corner of the roof is a small chitinous process to which muscles are attached. Perhaps these three structures represent the pseudosternite of other Orthoptera. According to E. M. Walker (1922), in Orthoptera the penis lies below the paraprocts and typically also under the cover of a projecting plate—the pseudosternite—which forms an arch over its base and serves for the origin of muscles. The arch may be prolonged into a pair of rami, partly encircling the penis at its base and inwardly forming endapophyses. Sometimes the endapophyses are separated from the pseudosternite and may be present in many (some Tettigonoidea) in which the pseudosternite has disappeared. This seems to be the case here—there is no pseudosternite, but the endapophyses remain.

The rectum, anal plates, and roof of the penis cavity may be removed and the penis observed. It is a single structure, wide and flattened dorso-ventrally. On its dorsal surface are two longitudinal grooves, so that it appears three lobed from above. The central lobe contains the ductus ejaculatorius, the thicker lateral lobes form its side-walls. The ductus opens at the end of the penis by a wide transverse mouth bounded by dorsal and ventral lips. The central lobe forms the dorsal lip. The ventral surface of the ductus is prominent and is deeply grooved in a longitudinal direction and its terminal portion forms the ventral lip. The penis is spinulose.

FEMALE REPRODUCTIVE SYSTEM.

This system consists of a pair of ovaries, a pair of oviducts, a median vagina and an unpaired spermatheca. The ovaries (Fig. 29) in a mature female are large pear-shaped bodies situated in the abdomen at the sides of the alimentary canal. Each ovary consists of a number of ovarioles or egg tubes, there being about thirty-eight to forty ovarioles per ovary. What appears to be the lower third of an ovary is in reality an egg-calyx i.e. the upper much dilated end of an oviduct, which serves as a pouch for storing the eggs, and may hold eighteen to twenty eggs at once. The ovarioles of insects are of

two kinds—those with cells specialized to provide nutrition for the ova (meroistic) and those without such specialized cells (panoistic). In the latter case the follicular epithelium is believed to provide nourishment for the ova. In *Hemideina* and in Orthoptera generally there are no specialized nutritive cells. Following e.g. Imms, 1925, we recognise three regions in an ovariole (1) a terminal filament, a slender thread-like prolongation of the peritoneal layer. All the filaments of one ovary are bound together forming a common thread,

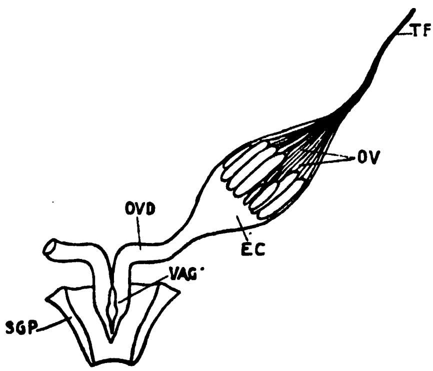


FIG. 29.—Female reproductive system.
EC., egg calyx; OV., ovarioles; OVD., oviduct; SGP., subgenital plate; TF., terminal filament; VAG, vagina with aperture.

which is inserted far forwards into the pericardial diaphragm; (2) the germarium, the region below the terminal filament which appears as a mass of nuclei. From this region are differentiated the ova and the cells of the follicular epithelium; (3) the vitellarium—the main portion of the ovariole. This region contains a linear series of ova gradually increasing in size as they near the egg-calyx. Each ovum is surrounded by its own coat of follicular epithelium. The nuclei of these cells show various stages of amitotic division. Amitosis is known to occur in the follicular epithelium of the cockroach, cricket, and hog-louse, and is perhaps general in the follicular epithelium of Insecta. Each ovum consists of a mass of yolk with a large nucleus or germinal vesicle and a nucleolus or germinal spot.

The ovarioles of an ovary are bound together by a thin layer of connective tissue, and such a layer surrounds each ovariole. In this layer numerous tracheae ramify, arising from branches from the fifth, sixth, and seventh spiracles. Within this layer is the follicular epithelium, whose cells rest upon a basement membrane. This epithelium grows inwards between successive ova in such a way that each ovum is enclosed in a complete follicle or sac. Besides its nutritive function, this epithelium secretes on its inner surface the egg-shell or chorion. In a mature ovary the last ovum in an ovariole usually has a well-developed chorion and all the ova in the egg-calyx have one. The chorion is tough and strong,

and brown in colour. Its external surface is marked out into hexagonal areas, and in the centre of each is a cavity or canal, from which finer branching canals spread out deeper into the chorion. Spines arise from the network of broad ridges surrounding these cavities. Seen in section (Fig. 30) the chorion shows two regions. The endochorion consists of three dense parallel layers of chitin closely connected to one another by numerous trabeculae. The exochorion is the region nearer to the follicular epithelium and consists of a network of ridges surrounding the canals or cavities mentioned above. The micropylar area is situated at the anterior (cephalic) pole of the egg. The egg itself is elongate oval and about five to six millimetres long.

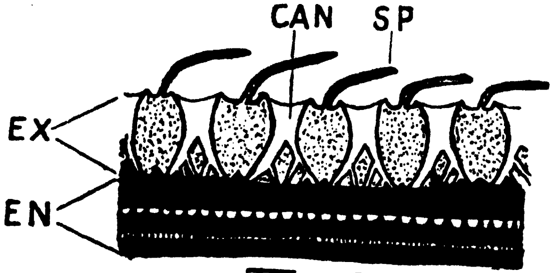


Fig 30

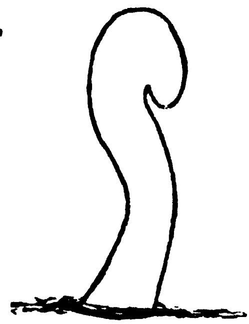


Fig 31

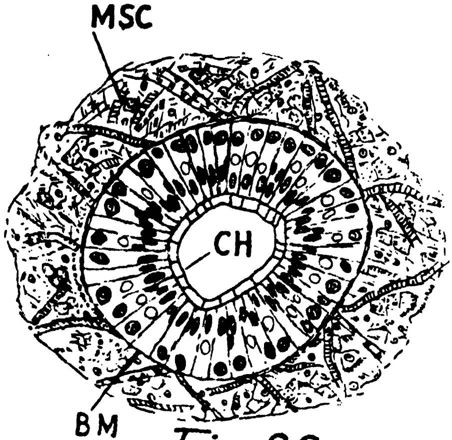


Fig 32

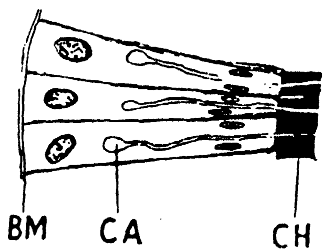


Fig 33

FIG. 30.—L.S. of portion of chorion of egg still in ovariole.
CAN., canal with diverticula; EN., endochorion; EX., exochorion; SP., spine.

FIG. 31.—Spermatheca, side view.

FIG. 32.—T.S. of spermatheca.
BM., basement membrane; CH., chitinous layer pierced by canals. Outside this are the two concentric circles of nuclei; MSC., muscular coat.

FIG. 33.—Small portion spermathecal wall, highly magnified.
BM., basement membrane; CA., chamber or dilatation at end canal; CH., chitinous layer lining lumen and pierced by canals. This figure slightly diagrammatic.

From the egg-calyx the oviduct of each side continues as a short narrow tube which unites with its fellow to form a short median vagina and this opens by a slit-like aperture upon the upper surface of the sub-genital plate. The sub-genital plate is connected to the seventh sternum by an articular membrane and can move up and down, its posterior margin being free.

The spermatheca (Fig. 31) is a median blind tube whose distal end is bent upon itself. It is situated below the rectum, and its opening is on a triangular plate just above the opening of the vagina. In cross-section (Fig. 32) it is seen to be lined internally by a thick chitinous layer. Outside this are two concentric cellular layers, and then a basement membrane. Finally outside the basement membrane is a fairly thick coat of muscle-fibres, the fibres running in various directions. The chitinous layer is pierced by minute canals (Fig. 33), which at one end open into the lumen of the spermatheca, pass through the chitinous layer and the first cellular layer, well into the second, where each canal ends in a small chamber or swelling. Owing to their minuteness the canals are difficult to trace through their whole length, but their arrangement appears to be as above described. The internal cellular layer probably represents the chitin-secreting epithelium and the external a glandular layer, whose products, no doubt, are collected in the chambers or swellings and pass thence by the canals into the lumen of the spermatheca, where they serve to nourish the sperms.

NOTE ON DEVELOPMENT.

In one night late in April, 1925, a female in captivity laid twelve eggs, and the following night nine eggs. They were laid singly in damp sawdust about half an inch below the surface. Six of these hatched out early in December of same year, so that the embryonic development in this case took about seven months. The first instar is shown in Fig. 3.

LITERATURE CITED.

BERLESE, A., 1909. *Gli Insetti.* Milano. Vol. 1.

BRUNNER, —, 1888. Monog. d. Stenop. und Gryll. in *Verh. k. k. Zool und Bot. Gesellsch.*. Wien, vol. 38.

BULLER, W., 1867. *The Zoologist*, vol. 2, p. 850.

BULLER, W., 1870. *Trans. N.Z. Inst.*, vol. 3, p. 34.

CAMERON, A. E., 1912. Structure of the Alimentary Canal of the Stick-Insect, *Bacillus Rossii. Proceedings of the Zoological Society of London.*

COMSTOCK, J. H. and KOCHI C., 1902. The Skeleton of the Head of Insects, *American Naturalist*, Vol. 36, No. 421.

CRAMPTON, G. C., 1920. Terminal abdominal structures of Male Insects. *Can. Ento.* Vol. 52, No. 8.

CRAMPTON, G. C., 1923. Preliminary Note on Terminology applied to parts of an Insect's leg. *Can Ento.* Vol. 55, No. 6.

DU PORTE, E. M., 1919. Propleura and Pronotal Sulci of Orthoptera. *Can. Ento.*, Vol. 51, Nos. 6 and 7.

FLORENCE, LAURA, 1921. The Hog Louse, *Haematopinus Suis* Linné; Its Biology, Anatomy and Histology. *Cornell University, Agricultural Experiment Station, Memoir 51.*

FULTON, B. B., 1915. The Tree Crickets of New York. *N.Y. Agric. Expt. Station—Tech. Bulletin No. 42.*
HEWITT, C. G., 1907. The Anatomy of the House Fly, *Musca domestica. Q. J. Micro. Sc.*, Vol. 51.
HUDSON, G. V., 1892. *Manual of New Zealand Entomology*, London.
HUTTON, F. W., 1896. The Stenopelmatidae of New Zealand. *Trans. N.Z. Inst.*, Vol. 29.
IMMS, A. D., 1925. *Text Book of Entomology*, London.
KIRK, H. B., 1924. A method of injecting the tracheae of Insects. *Trans. N.Z. Inst.*, Vol. 55.
KIRBY, W. F., 1906. *Synonymic Catalogue of Orthoptera*, Vol. 2, Part 1, London.
MARTIN, J. F., 1916. Thoracic and Cervical Sclerites of Insects. *Ann Ento. Soc. Am.* Vol. 9, No. 1.
MELIN, D., 1923. Contributions to the knowledge of the Biology, Metamorphosis and Distribution of the Swedish Asilids. *Zoologiska Bidrag.* Band 8.
MIALL and DENNY, 1886. *The Cockroach.* London.
PAVLOVSKY and ZARIN, 1922. On the structure of the Alimentary Canal and its ferments in the Bee. *Q. J. Micro Sc.*, Vol. 66, No. 263.
PACKARD, A. S., 1903. *A Text Book of Entomology.* New York.
RILY, PACKARD and THOMAS, 1880-82. *Third Report of the U.S. Entomological Commission.*
SHARP, D., 1901. *Cambridge Natural History*, Vol. 5. London.
SIEBOLD, C. Th. v., 1854. *Anatomy of the Invertebrata*, London.
SNODGRASS, R. E., 1910. *Anatomy of the Honey Bee*, U.S. Dept. Agric., Washington.
TEPPER, J. G. O., 1892. The Gryllacridae and Stenopelmatidae of Australia. *Trans. Roy. Soc. S. Aust.*
TILLYARD, R. J., 1917. *Biology of Dragon Flies.* Cambridge Zoological Series.
WALKER, F., 1869. *Catalogue of Dermaptera Saltatoria in British Museum*, Part 1. London.
WALKER, E. M., 1922. Terminal Structures of Orthopteroid Insects, Pt. 2. *Ann. Ento. Soc. Am.*, Vol. 15, No. 1.

Hemiptera Heteroptera from New Zealand.

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Communicated by J. G. MYERS.

[*Read before the Wellington Philosophical Society, 22nd October, 1924; received by Editor, 24th October, 1925; issued separately, 17th February, 1927.*

UP to recent years the hemipterous fauna of New Zealand has been considered exceedingly poor. In his list of the Hemiptera of this country, G. W. Kirkaldy (1909) enumerated 48 species of Heteroptera, but of these 2 have proved to be synonyms of other species included in the list, and no less than 12 are either imported or widely-dispersed species outside New Zealand. The number of known truly endemic species was thus at that time 34. In this number I include *Henicocephalus maclachlani* Kirk., which in my opinion is certainly endemic, although Kirkaldy said: "probably not endemic, but Australian, though not known elsewhere than in New Zealand." Since 1909 very few additions to this suborder have been made. The apparent scarcity of Hemiptera in New Zealand was in Kirkaldy's opinion due to insufficient collecting, and he had "no hesitation in estimating at least 750 species of endemic Hemiptera for New Zealand" and thought that "this is really much too little." I think that Kirkaldy's expectations were exaggerated, but however this may be, very important additions to the New Zealand hemipterous fauna have in the last years accumulated through the assiduous efforts of my zealous and highly-valued correspondent, J. G. Myers and his friends. The additions are especially considerable in the families Aradidae, Myodochidae and, above all, in the Miridae. The material of the Heteroptera has been submitted to me for determination, and I hope I may find time to describe the novelties in a series of papers. In this first instalment I am dealing only with groups poorly represented in New Zealand.

Fam. PENTATOMIDAE.

HYPSITHOCUS n. gen.

Body broadly ovate, somewhat depressed and laterally laminate. Head a little broader than long, as long as pronotum in the middle, flat, slightly concave in the apical half, moderately declivous, ampliated from collum to eyes, in front of each eye produced in a short, triangular, apically rather blunt, outwardly directed lobe, then narrowing, laterally and apically rather broadly rounded with thin acute margins, the anteocular part twice broader than long, clypeus gradually narrowed from base to apex, juga longer than clypeus and almost meeting in front of it, with an oblique callus on their under-side, ocelli wanting in the brachypterous form, antenniferous tubercles removed from laternal margins, not visible from above, antennae about half the length of body, gradually somewhat thickened from second to fifth joint, first joint not quite reaching apex of head, fourth with a distinct smooth basal stylus, bucculae low, straight, reaching base of head, rostrum reaching base of venter, first joint a little shorter than bucclae, second much shorter than

the two last joints combined, fourth shorter than third. Pronotum but little declivous, at apex a little broader than head and rather deeply biangulately sinuated, apical margin neither elevated nor levigated, its median part straight, its lateral parts oblique, touching the whole postocular part of head and posterior part of the eyes, apical angles passing posterior end of eyes, but not reaching their middle, with a very small tooth directed obliquely outwards, lateral margins moderately converging, not elevated, but broadly and slightly reflexed, almost straight from the obtuse non-prominent lateral angles to beyond middle, then rounded, basal margin in front of scutellum almost straight, in front of elytra a little oblique, not much deviating from the transverse axis of the body so that the lateral angles lie but little more forwards than the scutellar basal level. Scutellum much longer than broad, and reaching to a little beyond middle of antepenultimate dorsal segment (not counting the genital segment), almost gradually tapering from base to narrowly-rounded apex, at base scarcely narrower than head, with no distinct impression or callus at basal angles, frena reaching beyond middle of scutellum. Elytra across their greatest width a little broader than pronotum, in the brachypterous form a little longer than scutellum, slightly passing base of penultimate dorsal segment (exclusive of genital segment), corium in the brachypterous form exteriorly moderately rounded from base to beyond middle, then strongly rounded to apex of scutellum with costal and apical margins broadly rotundately confluent, exocorium broad, at the base but little narrower than somewhat before the middle, costal margin slightly reflexed at base, membrane very short, forming a narrow interiorly slightly widening strip attached to intero-apical margin of corium. Sterna sulcated in middle; metasternal orificia very small and short, not produced in a fold or furrow. Abdomen laterally evenly rounded, last female tergal segment broadly and slightly sinuate at apex, venter unarmed and not elevated at base, rather broadly and very slightly sulcated from its base to middle of fifth segment, spiracles very small, much more distant from lateral than from apical margin of the segments. Femora unarmed; tibiae sulcated above; first joint of tarsi slightly shorter than the other two taken together.

Although this genus has several characters in common with the Sciocorinae and Myrocheinae I place it provisionally in Staal's group 4 (21) of the true Pentatominae, but it is not nearly allied to any described genus. Owing to its complex affinities a very detailed description of it has been necessary. The genus is, judging from the figure, somewhat similar to *Trincavellius* Dist. from the Galapagos Islands, but Distant referred this genus, possibly in error, to the Discocephalinae, in which *Hypsithocus* can certainly not be placed.

Hynsithocus hudsonae n. sp.

Glabrous, scarcely shining, black (including rostrum and legs), outer margins of head, of prothorax, of corial basal part, and of connexivum very narrowly tawny with a tinge of olive-green, outer margins of venter narrowly greenish white; epipharynx white at base; antennae fuscous-black, apex of first three joints and base of

second narrowly pale testaceous, fourth and fifth joints ferruginous, apical third of fifth dusky; above densely and rather strongly punctate, much more finely so on abdominal tergum with connexivum and on under-side of body, middle of venter almost impunctate. Head a little less than half the width of pronotum, interocular space a little more than six times broader than an eye, first antennal joint a little thicker near base than at apex, second sublinear, third and fourth gradually somewhat incrassated from base to apex, fifth cylindrical apart from the narrowed base and apex, second and third joints of equal length, fourth distinctly longer than third and slightly shorter than fifth. Pronotum slightly over 2½ times broader than its medium length. Scutellum somewhat shorter than head and pronotum together. Corium in the brachypterous form with radial vein posteriorly strongly incurved, ending at apex of corium where it joins radial sector, of which only apical part is visible, cubital vein ending in inner margin of corium immediately behind apex of narrow clavus, which is as long as frena, all veins impunctate, but scarcely elevated. Abdomen with sixth female ventral segment in middle twice longer than fifth, female dorsal genital segment over three times broader than long, its apical margin straight, toward lateral ends a little rounded. Length, ♀ 8.8 m.m., width, 5.8 m.m.

Of this insect—doubtless an endemic form—only two specimens are known, one of which I have seen. They were found by Miss Stella Hudson at a considerable elevation above the bush-line at Lake Wakitipu in the southern part of the South Island. The still unknown macropterous form will possibly be obtained at a lower elevation.

Fam. **TINGIDAE.**

Subfam. **CANTACADERINAE.**

CYPEROBIA n. gen.

Body narrowly rhomboidal, its greatest width a little behind middle. Head triangular, longer than broad, shorter than pronotum, the anteocular part provided with four robust, rather short, tubercle-like spines directed forwards and upwards and arranged in two pairs, one behind the other, the anteantennal part as long as postantennal part, bucculae rather low, apically roundly meeting in front of clypeus, posteriorly curvedly divergent and ending at base of head a little inside the eyes, first antennal joint suboval, second narrower than first and about half its length, subglobular, not nearly reaching apex of head, third long and very slender, fourth fusiform, as long as the two first together; (the length of the rostrum cannot be stated in the single carded type). Pronotum broader than long, divided by a laterally abbreviated transverse impression into two lobes, interior lobe less than half the length of the posterior and forming, seen from side, an angle with anterior declivity of the longitudinally and transversely convex posterior lobe, at apex a little narrower than head, across widest part of the posterior lobe more than twice wider than apically, apical margin very slightly sinuate, basal margin straight, the greatest part of the anterior lobe occupied by an anteriorly truncate,

laterally and posteriorly rounded, finely areolated vesicle leaving only the small flattened postero-lateral parts of lobe free, posterior lobe much broader than anterior, its disc finely punctulate, with five keels, the three median keels subparallel, ending in the transverse impression except the central keel which traverses this impression, feebly continued over the vesicle which also shows traces of sub-lateral keels corresponding to outer ones of median keels of basal lobe, the outermost keel on each side of posterior lobe much weaker than the others, placed near lateral margins and subparallel to them, lateral margins of anterior lobe obliquely straight, diverging backward, those of posterior lobe rounded from base to a little beyond middle, paranota represented by a non-areolated carina. Scutellum exposed but very small, triangular, near apex raised into a tubercle. Elytra rather longly passing apex of abdomen, very minutely areolated, in discal area punctulated rather than areolated, widest a little before the middle, entirely overlapping at apex, median vein and its two branches forming the discal area strongly elevated, the oblong somewhat irregular discal area divided by two cross-veins into three cells, the foremost triangular cell the smallest, the median cell the largest of all, the anterior cross-vein transverse or almost so, the posterior oblique, radial area in its widest part almost as broad as median cell of discal area, at this place traversed by a cross-vein and posteriorly by two shorter or incomplete cross-veins, costal area biseriately areolated, near base inwardly dilated and there tri- or quadriseriate. The areolets larger than those of the other areas. Wings but little shorter than elytra. Legs slender.

The only genus to which *Cyperobia* is allied is the South African *Astolphos* Dist., and in the venation of the elytra it is very similar to it. It differs from that genus by the lozenge-shaped, laterally less rounded body, the shorter head which is armed above with four short robust spines, and the 5-carinate pronotum, the apical margin of which is very much less sinuate.

Cyperobia carectorum n. sp.

Head above dark testaceous, fuscous at base, first, second and fourth antennal joints fuscous, third testaceous, as long as head and anterior pronotal lobe together. Pronotum fuscous-black, lateral carina of anterior lobe, a stripe between sublateral and lateral carina of posterior lobe, and the anterior ends of the three discal carinae of this lobe testaceous. Scutellum black. Elytra greyish fuscous, basal part of radial area as far as to first cross-vein, costal area, and exterior basal part of sutural area testaceous, an oblong rectangular costal spot a little before middle and transverse veinlets of exterior series of costal areolets black. Body beneath fuscous-black, a spot on hinder part of propleurae, a lateral spot to ventral segments, and female genital segments testaceous. Legs testaceous, femora (except a subapical annulation) and tarsi fuscous. First cross-vein of radial area forming a continuation of anterior cross-vein of discal area, the two short posterior cross-veins emitted from the hindmost cell of discal area. The areolets of costal area quadrangular. Length, ♀ 3 m.m., incl. teg. 4 m.m.

Gollan's Valley, Wellington, 5th February, 1921, on sedges. Three specimens of it have been found by Mr. G. V. Hudson on 8th March, 1924 in the Karori Reservoir Reserve, Wellington, probably on *Cassinia leptophylla* R. Br., but I have not seen these examples.

This is the first Tingid recorded from New Zealand. It is certainly endemic.

I agree with Staal that in the Cantacaderinae it is the radius (not the costa) that is carinately elevated on the under-side. The costal area (described by Horvath as the costal membrane in *Cantacader*) is situated outside the abdominal margin and there is no costal membrane.

The subfamily Cantacaderinae has not yet been found in Australia, but I have recently received another undescribed genus of it (with little affinity to *Cyperobia*) from Lord Howe Island.

Fam. **REDUVIIDAE.**

Subfam. **Ploeariinae.**

Ploeariodes rubromaculatus Blackb.

Of this widely dispersed, almost cosmopolitan species I have seen two specimens taken by Prof. R. J. Tillyard, Nelson, at Mowhere (24th April, 1921). Mr. Myers has also sent me a specimen bearing the number 46b, from Nelson. A specimen marked 46a was taken at the same place and probably thought to be the same, but it is another species. The red streak of the stigma in *rubromaculatus* is sometimes pale orange and occasionally lacking.

Ploeariodes aculeatus n. sp.

Head brown, postocular part above with two rather broad white vittae with a brownish nucleus, on the sides with a few white dots, anteocular part in male much shorter than postocular, eyes in male very large, occupying the whole height of head, interocular space in that sex narrower than an eye, longitudinally impressed in the middle, antennae in male rather densely beset with moderately long, outstanding white hairs, pale testaceous, first joint reaching well beyond base of abdomen, with about 10 fuscous rings narrower than adjoining pale parts, except the last ring, which is apical, broader and darker than the others, second joint about as long as first, with the narrow base and apex and in basal part four blackish rings as broad as adjoining pale parts, third joint as long as pronotum, blackish (fourth lacking), rostrum white, a median ring to first joint, the second (except apex) and third fuscous, first joint in male reaching beyond anterior margin of eyes. Pronotum distinctly somewhat narrowed from base to apex, at base without a tubercle, basal margin slightly trisinuate, fore lobe fuscous black with a tubercle posteriorly near sides and with two white approximated vittae set with white hairs, posterior lobe a little longer than broad, double the length of fore-lobe, brown with two discal whitish vittae convergent and gradually narrowed forwards, reaching apical, but not basal margin, which is also narrowly whitish and at sinuosities dilated into a small triangular whitish spot, whitish lateral keel percurrent, parallel with posterior margin of propleura, only anteriorly directed a little forward, but not ending in a spine

or lobelet. Scutellum without a distinct spine. Metanotal spine short, whitish, horizontal. Pectus brown, meso- and metasternum with a white median keel and laterally with a similar shorter keel. Elytra passing apex of abdomen, subhyaline, spotted with grey, on each side a little before apex obtusely angular, margin straight between those points and apex, which is pointed, the straight apical vein projecting a little (very narrowly membranously margined) beyond margin of tegmen in the form of a small prickle, basal part of costal border (between radial and median vein) with oblong fuscous-grey parallel spots which are oblique at each end, inner portion of basal part (between median vein and interior margin) with smaller and lighter-grey markings, space beyond great membranal cell with larger and darker grey spots, especially along margin, but with a suboval spotless area under middle of stigma behind radial cross-vein, the great cell of the membrane with much fewer spots so that it appears lighter in hue than the rest of the elytron, at apex rostrately produced, radial cross-vein and apical part of vein closing the cell interno-apically angularly bent, bordered with fuscous-grey, costal margin with a fuscous streak in centre and an oblong blackish spot before stigma, which is pale yellowish with no dark spots. Wings subhyaline, dusky at apex. Abdomen in male rather narrow, opaque, fuscous-grey, upper basal spine directed a little backwards, ventral genital segments yellowish, the first with a dark median vitta forming a continuation of ventral blackish median line, which is distinct only in the two last segments and a little dilated at base of these segments, second genital segment emarginate at apex, dorsal genital segment rounded apically, claspers curved. Front coxae as long as pronotum, white, fuscous at apex, trochanters whitish, the rest of the legs fuscous, femora nearly as long as head and pronotum together, with a basal and two submedian annuli near each other whitish testaceous, beneath set with short hairs, tibiae with two such annuli, tarsi pale at base. Middle legs whitish, femora and tibiae each with about 8 fuscous annuli, the tibial rings disappearing toward apex which is fuscous as the tarsi. (Hind legs missing). Length, ♀ 4 m.m., incl. tegm. 4.5 m.m.

Northern Auckland, *T. R. Harris.*

Remarkable on account of the structure and colouring of the pronotum and the apically aculaetely projecting elytra.

Ploeariodes angulipennis n. sp.

Head dark brown with short white silvery hairs along ocular orbitae and the transverse impression, and on postocular part, where they form two or three irregular vittae above and on the sides, anteocular part in male a little shorter than postocular, eyes in that sex moderately large, not occupying the whole height of head, interocular space conspicuously broader than an eye, antennae in male rather sparsely set with moderately long outstanding pale hairs, fuscous, first joint reaching nearly to middle of abdomen, with six or seven annuli and apex white, second joint about as long as first, with about four indistinct pale annuli, third joint longer than pronotum (fourth lacking), rostrum greyish white, base and a postmedian ring of first joint, and more than apical half of second fuscous, first joint reaching

posterior margin of eyes. Pronotum scarcely narrower at apex than at base, brown with white tomentosity forming two rather indistinct vittae, a little constricted at base of fore-lobe, which on each side of the disc has the usual tubercle, posterior lobe about as long as broad, without a basal tubercle, basal margin whitish, sinuate in front of scutellum, lateral keel of lobe whitish, percurrent, slightly sigmoid, a little thickened anteriorly, but not forming a lobelet or spine. Scutellum with a short horizontal rather robust whitish spine, the whitish metanotal spine a little longer, semierect. Meso- and meta-pleurae with a few short whitish streaks. Elytra rather longly passing apex of abdomen, greater part of stigma lying behind it, at posterior end of stigma angularly dilated, extero-apical and opposite intero-apical margin then straight, strongly converging toward narrowly-rounded apex, basal part of elytra (before furcation of median vein) whitish with two rows of fuscous-grey spots, spots of exterior row small and narrow, those of interior row larger, rounded, divided into halves by white median vein, interior border of that part less distinctly spotted, the rest of elytra greyish brown with white veins and rather densely reticulated with white, stigma whitish without dark spots, a short narrow costal spot somewhat before stigma and an oval costal spot a little behind stigma blackish, the latter spot continued inward and forward in the form of an oblique long dark fuscous fascia almost reaching interior margin, this poststigmal spot separated from stigma by a short white space continued along the inner margin of apical half of stigma, the great membranal cell at apex shortly rostrately produced, veins closing posterior part of that cell slightly bent, apical vein straight. Abdomen (♂) narrow, somewhat clavately incrassated at apex, fuscous with a greyish bloom, a denudated dark median ventral line less distinct toward base and somewhat dilated at base of segments, an oblong spot at basal angles on ventral segments, spiracles, apical half of male ventral genital segment, and claspers yellowish white, genital segment longer than the last ventral segment, its apical margin slightly rounded. Fore-legs fuscous, coxae (except apex), a ring to femora nearer to apex than to base, and two annuli to tibiae whitish, coxae as long as pronotum, femora about as long as head and pronotum together, beneath thickly set with rather short hairs and among them near base with about four fuscous spines shorter than the hairs. Hind femora passing apex of elytra, whitish with about 8 fuscous annuli which are darker and broader in apical half. (Middle legs and hind tibiae wanting). Length, ♂ 5.4 m.m., incl. tegm. 6.4 m.m.

Masterton, 26th March, 1921, *H. Hamilton.*

Readily distinguished by the shape and colouring of the elytra.

Mr. Myers has sent me a female *Ploeariodes* with the label 46a and showing the following characters: Tegmina only reaching apex of penultimate tergal segment, less angular behind the very narrow stigma, radial area of basal part fuscous with about five oblique white bars, the long oblique fuscous fascia emitted from the blackish, poststigmal spot scarcely distinct, apical margin very obtuse—angled, and fuscous spinules of fore-femora rather numerous, although lacking in apical part; other characters much as in *P. angulipennis;* length, 5.9 m.m. This specimen is possibly the brachypterous female of *angulipennis.*

Ploeariodes seorsus n. sp.

Short and robust, ferruginous, the rather broadly-raised lateral borders of anterior pronotal lobe, venter at apex or entirely, sometimes also pleurae dark fuscous, tegmina from base to fork of median vein pale testaceous with a fuscous sublateral stripe interrupted by one or two white bars, the large and broad postfurcal radial cell* dull black with two small white flecks, membrane fuscous, a large patch adjoining to inner margin of postfurcal radial cell and extended somewhat behind it, and a large V—or Y—shaped apical marking ochreous, both the fuscous and the ochreous parts with white reticulations. Head sparsely set with very short white hairs sometimes forming two faint vittae on postocular part, basal part produced over anterior part of pronotal fore-lobe, base seen from side oblique, postocular part higher than anteocular, flattened above, its anterior and posterior margin dipping abruptly, eyes rather small in both sexs, interocular space about two times wider than an eye, (♂) or a little wider (♀), antennae bare in both sexes, comparatively short, first joint as long as head and pronotum together, pale testaceous with five or six fuscous annuli, tip somewhat curved, other joints fuscous, second one-third shorter than first, its apical half testaceous or with two or three very indistinct annuli of that colour, third conspiciously shorter than second and about as long as pronotum, fourth a little over half length of third, rostrum testaceous, apical joint much paler. Pronotum without a basal tubercle, anterior lobe owing to position of head much shorter in middle than at sides, where it is about twice as long as posterior lobe, a little rounded laterally and a little broader than hind-lobe, the raised lateral parts with an oval ring consisting of short decumbent silvery hairs and emitting two short similar branches from its inner margin, posterior lobe about twice broader than long with rounded sides, basal margin angularly siniuate, near middle of disc with two blunt ridges a little converging posteriorly, not reaching base, but feebly continued over median part of fore-lobe and clothed with short deciduous white hairs, lateral keel whitish, percurrent, slightly sigmoid or curved, not forming a lobule or spinule at apex, posterior margin of propleura often pale. Scutellar and metanotal spine white, long and slender, directed obliquely backward. Elytra about reaching apex of abdomen, stigma fuscous, broadly testaceous at base and sometimes narrowly so at apex, the large basal cell of the membrane posteriorly rostrately produced in its interior half, radial, cross-vein somewhat curved, very long, about twice longer than the rather strongly curved apical part of interior vein. Abdomen oval, 2½ (♂) or nearly 3 (♀) times broader than thorax, somewhat shining, first male ventral genital segment about as long as last ventral segment, transversal, its apical margin almost straight, second genital segment shorter, sinuate at apex, claspers almost straight, reaching apex of second genital segment, clavate in their apical part. Fore-legs rufo-testaceous, coxae brown, about as long as height of postocular part of head and less than three times

*In this genus a transverse vein is emitted from the furcation of M. obliquely forward and outward to R. The space between this transverse vein and the point where M meets R (usually coincident with the base of the stigma) I call the postfurcal radial cell. It is often divided by a cross-vein.

longer than their own breadth, narrowing from base to apex, femora stout, slightly curved, as long as pronotum and about three times longer than broad, beneath sparsely set with short hairs and armed with some slender spines of which the two placed nearest to base are very long, tibiae with a paler ring before infuscated apex. Middle and hind legs pale testaceous, femora and basal half of tibiae in intermediate legs with about 5, in the hind legs with about 7 narrow fuscous annuli, hind-femora passing apex of abdomen. Length, ♂ 3.3 m.m., ♀ 3.7 m.m.

Wainui State Forest, Wellington, 3rd June, 1923, *J. G. M.*

A highly aberrant form, not resembling any other New Zealand species, nor allied to any form described from other regions, but in spite of its many unusual characters it can hardly be separated generically. It is the only known species in which the pronotal fore-lobe is much longer than the hind-lobe. The great discal cell of the membrane is shaped quite as in the North American *P. winnemana* Mc At. Mall. The male genital apparatus resembles that of *P. rubromaculatus* Blackb., but the apical margin of the first genital segment is not notched in the middle and the second is much less deeply sinuate at apex. The postocular part of the head is constructed as in two species of another genus, the palaearctic *Ploearia abrupta* Noualh and *Putoni* Noualh.

More species of *Ploeariodes* can be expected to occur in New Zealand. They should be examined with a very strong lens, and a microscope is necessary to see certain characters clearly, for instance the armature of the fore-femora and the structure of the male genital segments, in some species even the distribution of the silvery hairs and the exact shape of the veins closing the great discal cell posteriorly.

Ploearia antipodum n. sp.

Apterous; blackish or fuscous, more or less ochreous on upperside of head and on nota; antennae testaceous, about apical fifth of first joint blackish with a white ring in basal half of black part, apex of second and (narrowly) of third joint white; rostrum fuscous, basal part of second and third joints yellow; fore-legs brown, coxae slightly and femora much more markedly variegated with testaceous, tibiae in the middle broadly and base of tarsi testaceous, the four posterior legs fusco-testaceous, their tibiae with a pale annulation not far from base, femora sometimes with four pale rings (one quite near base) and apex of hind femora sometimes pale. Head about as long as mesothorax, anteocular part seen from above parallel from eyes to antennae, in front of antennae somewhat produced obliquely downward, postocular part subgradually narrowed to base, seen from above very slightly constricted in middle, antennae longer than body, first joint longer than head, thorax, and scutellum taken together, second about one-fourth shorter than first, third a little shorter than head, fourth somewhat variable, at most a little longer than third, first joint of rostrum reaching middle of anteocular part of head, second somewhat longer than first, almost reaching posterior margin of eyes. Pronotum about as long as the other nota together, gradually narrowing from apex to base, at apex broader than head; mesonotum as long as metanotum and scutellum together, widened from apex

to base, metanotum slightly longer than scutellum, impressed and carinate in the middle. Scutellum with a median carina, broad at apex. Mesosternum feebly carinate down the middle. Elytra replaced by very short and narrow wing-pads. Abdomen a little longer than the rest of body, rather narrow, at apical part of lateral margins of the four last segments more or less lobately dilated, penultimate dorsal segment of male angularly somewhat produced over the last, which is deeply sinuate at apex, last ventral segment bisinuate at apex, claspers short, curved, dorsal plate of first female genital segment declivous, a little narrowed from base to apex, which is a little sinuate, second female genital segment still more declivous and more narrowed toward the blunt apex. Coxae of fore-legs a little shorter than head and pronotum together, trochanters unarmed and with no bristles or hairs, femora conspicuously longer than coxae, beneath throughout with close-set short bristles becoming still shorter toward apex, but with no spines, tibiae not reaching middle of femora, tarsi a little shorter than tibiae. Hind femora passing apex of abdomen by about two-fifths their length. Length, ♂ 14 m.m., ♀ 14-15 m.m.

Wellington, April, 1923, *R. Grimmet;* Wainui State Forest, 3rd June, 1923, "imitated dead stalks," *J. G. M.;* Karori, Wellington, 18th January, 1924 (*T. Cockroft*) and 17th April, 1920; York Bay, Wellington, 3rd February, 1924, *J. G. M.*

This large species is neither allied nor similar to the other New Zealand species, *P. Huttoni* Scott, nor can it be compared with any other described species. The lateral lobes of the abdomen are variable in size; in some specimens they are well developed, in others quite inconspicuous.

Fam. **NABIDIDAE.**

Alloeorrhynchus myersi n. sp.

Black, hind lobe of pronotum flavescent with a diffuse median spot and lateral borders fuscous, a costal vitta of corium from base to beyond middle, basal half of connexival segments above and beneath, often also a ventral median patch from base of third to apex of fourth segment pale yellow; antennae, rostrum, and legs yellowish testaceous, antennae a little darker in hue, last rostral joint, fore femora (except apex and base), a subapical ring to the other femora, and fore tibiae beneath toward apical dilated part piceous. Head as long as but narrower than anterior pronotal lobe, anteocular part as long as the eyes, second antennal joint (including minute basal supplementary jointlet) not quite twice the length of the first, very slightly thickened toward apex, rostrum when straightened reaching middle coxae, second joint a little shorter than the two last joints together. Pronotum almost impunctate, fore-lobe more than twice the length of rear lobe, with a lateral impression above the acetabula, hind-lobe about one-half broader than fore-lobe, its sides divergent backward, forming an angle with the sides of the fore-lobe. Scutellum longer than hind-lobe of pronotum. Elytra reaching apex of abdomen, the yellow costal vitta gradually broadened from its narrow base to beyond its middle, then again moderately narrowed. Fore and middle femora angularly ampliated beneath and with a tooth at that place, front femora about 2½ times longer than broad, space between tooth and apex

with a row of very minute teeth each bearing a hair, middle femora much narrower than fore ones, anterior and intermediate tibiae straight, the spongy fossa of the anterior ones occupying a little more than their apical third. Length, ♂ ♀ 4 m.m.

Kaitaia, North Auckland, 13th May, 1923, *J. G. M.*

Allied to *A. flavolimbatus* Kirk., but smaller, with differently coloured pronotal hind-lobe, connexivum, and four anterior legs, and with shorter rostrum and pronotal fore-lobe. The genus *Alloerrhynchus* Fieb. is dispersed almost throughout the world, but is new to New Zealand.

Reduviolus biformis n. sp.

Dark soiled testaceous, a narrow, medially somewhat broader, percurrent central vitta of pronotum, basal half of scutellum and a median vitta of its apical half, median parts of sterna, irregular markings of pleurae, a spot at basal angle of connexival segments, the broad intraconnexival borders of venter, and a median stripe of venter (often abbreviated or interrupted toward base) blackish or fuscous; antennae, rostrum, and legs testaceous, transverse fasciolae of femora, base and apex of tibiae, and apex of tarsi fuscous, femora sometimes entirely infuscated. Head with interocular space not quite twice as broad as an eye, postocular part parallel, first joint of antennae not much thicker than second, shorter than head, second not fully twice longer than first, third a little shorter than second and longer than fourth. Pronotum impunctate, basal margin broadly and very slightly sinuate or almost straight, anterior lobe about one-half longer than posterior, transversely convex. Venter well separated from connexivum, its segments without a denudated shiny sublateral spot. Fore and middle femora beneath devoid of spines or long hairs. Length, ♀ 8.5—9 mm.

Macropterous form: Pronotum about as long as head, at sides very distinctly sinuate behind middle, at base more than three times broader than at apex, posterior lobe rather strongly declivous, forming an angle with the moderatetly declivous anterior lobe. Elytra reaching apex of abdomen, radiating veins of membrane present only between the innermost longitudinal vein and the adjacent margin.

Brachypterous form: Ocelli present, but smaller than in the macropterous form. Pronotum a little shorter than head, at sides slightly sinuate behind middle, at base twice as broad as at apex, slightly declivous in same plane, posterior lobe not more sloping and not forming an angle with anterior lobe. Elytra little more than twice the length of scutellum, without membrane, claval commissure shorter than scutellum, outer margin of corium incurved posteriorly, apical angle somewhat distant from lateral margin of abdomen, apical margin obliquely straight, forming a right angle with the apical margin of the other corium. Tergum of abdomen somewhat elevated down middle, usually more or less greyish black, a little shiny, with three dull brown vittae visible only in certain lights.

N. Auckland, *T. R. Harris*, Herne Bay, Auckland, 24th February, 1919, *G. Howes*, Henderson, Auckland, 14th February, 1922, *J.G.M.*; Whangarei, 18th February, 1923, *J. G. M.*

The elytra of the brachypterous form are not unlike those of the brachypterous form of the palaearctic *R. maracandicus* Reut., but outer margin of corium is less curved, apical margin is more deviating from longitudinal axis of body, and there is no membrane at all. Totally distinct from the cosmopolitan *R. capsiformis* Germ. (*Saundersi* B. White), which occurs also in New Zealand, and apparently also from *R. maoricus* Walk., which is unknown to me. Owing to the scant material, I have been unable to examine the alar cell. The male is still a desideratum.

Reduviolus quadripunctatus n. sp.

Above dingy ochreous, elytra paler and under-side of body darker in hue, two approximated subparallel lines on vertex, a narrow vitta running from apex of pronotum to apex of scutellum, two or three (rarely one) mesosternal vittae, tergum of abdomen, a narrow ventral vitta along inner margin of connexivum more or less extended over pleurae, a median ventral stripe, and sometimes also a sublateral line to anterior pronotal lobe dark fuscous or piceous, a small black spot on radial vein of corium a little behind its middle, a similar spot near middle of apical margin of corium, sometimes also extreme apex of clavi black, veins of membrane fuscous; antennae, rostrum, and legs testaceous, fore and middle femora with a row of often very pale brownish spots on posterior side, apex of tarsal joints fuscous. Head a little shorter than pronotum, interocular space a little over twice as broad as an eye, postocular part parallel, first joint of antennae somewhat thicker than second, as long as anteocular part of head with the eyes, second half as long again as first, third usually a little longer than second, fourth a little shorter than second. Pronotum impunctate, slightly if at all declivous in the same plane, truncate at base, lateral margins scarcely sinuate behind middle, anterior lobe nearly one-half longer than the hind-lobe, in the middle longitudinally somewhat elevated and shining from the collar to its base. Elytra more or less passing apex of abdomen in male, only reaching or almost reaching abdominal apex in female, rather narrow, not much overlapping from end of clavi to their apices, broadest a little before middle, then tapering toward their narrowly rounded apices, claval commissure more than twice as long as scutellum, the narrow membrane with few longitudinal simple veins and usually no distinct radiating veins. Wings tinged with lacteous, with a blackish dot on the slightly dilated end of hamus, which arises from *vena connectens* near base of *vena decurrens* and nearly reaches primary vein. Abdomen as broad as elytra in male, considerably broader than them in female and in this sex with connexivum (sometimes also lateral parts of tergum) uncovered, venter well separated from connexivum, its segments without a denudated lateral spot, male claspers shaped much as in the *ferus*-group of this genus. Legs finely and very shortly tomentose, fore and middle femora beneath without spines or long hairs, the front pair incrassated. Length, ♂ 7 m.m., incl. elytr. 8.5 m.m., ♀ 6.8—7.8 m.m.

Wellington, 9th October, 1920, *J. G. M.*; Longacre, Wanganui; Day's Bay, Wellington, 14th December, 1922, *J. G. M.;* Waikanae, 4th February, 1921; Aramoho, Wanganui, 26th December, 1923;

J. G. M.; West Coast, S.I., *T. R. Harris;* Ohakune, *T. R. Harris;* Governor's Bay, Canterbury, November, 1923, *J. F. Tapley;* Aroha, Auckland, *Major Broun.*

Belongs to *Reduviolus* s. str. It is smaller than the preceding species and very distinct from it, although *biformis* also probably can be included in the same subgenus.

Fam. **HENICOCEPHALIDAE.**

HENICOCEPHALUS MACLACHLANI Kirk.

In this species, of which I have seen a few specimens from two or three localities, the discal cell is open. It seems to be somewhat variable in size and in the shape of the basal lobe of the head. The elytra are shining with very conspicuous veins. The sexual differences in this species are not yet clear, and it is not impossible that two related species have been confounded under one name. To decide this, numerous and fresh specimens are needed. Specimens of this genus are occasionally found under fallen leaves, but they should be looked for at sunset, when they gather in great swarms, dancing in the air like gnats. This has been stated in many countries, and is probably a kind of nuptial flight. They are best preserved in alcohol.

GAMOSTOLUS n. gen.

Rostrum stretched forward, declined toward apex, but not inflected under head, tapering from the more or less broad base to apex, joints of maxillary palpi, of which it is composed, fused toward base of rostrum, separated only by an extremely fine and often wanting line, toward its apex more distinctly separated. Basal lobe of head well defined anteriorly by a transverse impression. Pronotum roundly narrowing from base to apex, not divided by two transverse impressions into three lobes, but with disc a little convex, slightly and indefinitely impressed in middle, or flattened, at lateral margins very slightly if at all constricted at posterior margin of collar and behind middle, basal margin straight, apical collar distinct, complete, reaching lateral margins, but more or less well defined posteriorly. Fore-coxal cavities open behind. Fore-coxae oblong. Fore-tibiae at interior end produced in a stout process intero-apically armed with some tubercles or spines. Middle and hind-tarsi two-jointed. Venation of tegmina as in the genus *Henicocephalus* Westw.

Type: *Henicocephalus subantarcticus* Berg from Fuegia, of which Prof. Berg many years ago sent me two well-preserved co-types.

A primitive genus allied to *Aenictopechys* Bredd., but the impressed line, which longitudinally halves the rostrum, is less distinct or wanting toward the base, the basal lobe of the head is well separated from the remainder of it, the pronotum has a distinct and transversely precurrent apical collar, and the tegminal venation is totally different, being greatly reduced and simple in Breddin's genus, the single species of which, *Aen. necopinatus* Bredd. from Java, also occurs in Sumatra (Wai Lima, Lampongs) from where Dr. Karny sent several specimens, "beim Zeltlager im Urwald angeflogen." In the latter genus the pronotal collar does not reach the lateral margins, but the line defining it posteriorly is suddenly

rectangularly bent forwards on each side, reaching only the apical angles. There is thus a "*strictura spuria*" similar to that of the subfamily Mirinae. This species is the smallest hitherto-described member of this family, whereas *Gamostolus subantarticus* surpasses all other Henicocephalidae in size and stoutness.*

Gamostolus tonnoiri n. sp.

Above quite opaque, black or fuscous-black, only the head a little shining, beneath fuscous; antennae fuscous; rostrum yellowish, fuscous at base; legs testaceous, here and there fuscescent. Head a little longer than pronotum, the posterior lobe a little longer than broad and slightly broader than width across eyes, laterally very slightly rounded, almost parallel, ocelli rather near one another, the distance between them scarcely twice the diameter of one ocellus, antennae short, about as long as head, the three last joints subequal in length, each of them a little longer than first, which passes apex of head a little, rostrum a little convex. Pronotum flattened with no trace of discal impressions, sparsely set with almost recumbent bristles, especially near margins, collar terminated behind by a fine line. Scutellum triangular, flattened. Elytra reaching slightly beyond apex of abdomen, so dull that the venation is faintly visible only with the aid of the microscope and strong electric light. Fore-legs strongly incrassated, femora scarcely three times longer than broad, tibiae gradually but highly dilated from base to apex, where they are almost broader than femora, their interior apical process armed with some spines, tarsus armed beneath with two spines abreast, claws about as long as tarsus, subequal in length, the outer one only slightly shorter. Hind legs slender. Length, 4—4.5 m.m.

Korokoro, Wellington, 30th March, 1921, *G. V. Hudson*; Nelson, 13th January, 1922, *A. Tonnoir.*

Judging from the rather small, only slightly prominent eyes, the specimens before me are females.

Much smaller and more slender than *G. subantarticus* Berg, which differs from the New Zealand species also in the following points: the rostrum is shorter, broader at base and flattened, the second antennal joint is much longer, basal lobe of head is shorter, transverse, laterally more rounded with much more separated ocelli, pronotum is slightly and flatly impressed in centre, collar separated from disc by a broader, obtuse impression, elytra are tawny with veins fuscous and therefore quite conspicuous, fore-tibiae are parallel from apex to beyond middle, then obliquely narrowed to base, and their interior apical process is on its inner side armed with tubercles (instead of spines).

That this genus is represented only in the southernmost part of America and in New Zealand is an additional proof of the near faunal affinities of these distant countries.

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*The African *Aenictopechys Alluaudi* Jeann. is not allied to that genus, but much more so to *Henicocephalus*, and it is difficult to understand why Jeannel placed it in Breddin's genus, with which it agrees only in the structure of the rostrum. The pronotum has the two usual deep transverse impressions (although the lobes are differently subdivided), the fore coxal cavities are closed behind, the fore coxae are globular, the tegminal venation is totally different, and the four posterior tarsi are one-jointed. It is the type of a new genus for which I propose the name *Aerorchestes*.

On the Nomenclature of New Zealand Homoptera.

By J. G. MYERS.
1851 Science Exhibition Scholar for New Zealand for 1924.

[*Read before Wellington Philosophical Society, 22nd October, 1924; received by Editor, 31st December, 1925; issued separately, 19th February, 1927.*]

IT is hoped to publish from time to time contributions towards a knowledge of New Zealand Homoptera (order Hemiptera or Rhynchota), or cicadas, leaf-hoppers, scale-insects, and aphides. These papers will, as previously, take the form of revisions of families or sub-families rather than descriptions of odd new species. But during the course of this work and especially in consequence of an examination of all the available types of New Zealand Homoptera in European museums, a number of nomenclatural changes involving species in several families have become necessary, and these are presented here *en masse* in order that they may be assimilated into New Zealand entomology without waiting for the revision of the families concerned.

I wish especially to thank Mr. W. E. China of the British Museum for facilitating in every way my study of the types at that institution during a part of the summer of 1925.

CICADIDAE.

The genus *Melampsalta* Kol. has been a pitfall to the taxonomist, and events have shown that it is hardly possible to elucidate the nomenclature of the New Zealand species without extensive series and a knowledge of the insects in the field. Apparently the Fabrician and Walkerian types of New Zealand cicadas were examined by Kirby, Staal, Distant, and Kirkaldy, and different interpretations published. I am unfortunately compelled to differ from many of these views, and especially from those of Distant to which I subscribed in 1921, when my revision of the N.Z. species was published. My only excuse for supposing that the interpretation now offered is final is that I have examined extensive series of most of the species, from most parts of their range, and comprising several thousands of specimens; that I have studied the internal genitalia in greater detail than my predecessors, and observed the insects in the field, where the song is a specific character of great importance.

The full synonymy is not given here but only the references essential to demonstrating clearly the changes in nomenclature. Species not mentioned stand as in my *Revision* of 1921 (*Trans. N.Z. Inst.*, 53, 238-50, pl. 45-6).

Melampsalta cingulata (Fabr.)

The type material in the British Museum (Banksian collection) consists of two entirely normal males. Walker's type of *Cicada indivulsa* is a rather stout female of *cingulata,* while *C. mundosa* of the

same author is a typical male with the pygophor missing. This synonymy has been correctly indicated by previous writers and in addition *Cicada zealandica* Boisd. is apparently referable to the same species. At the Museum of Natural History, Paris, Mons. E. Séguy, in charge of Diptera and Hemiptera, kindly showed me the New Zealand cicada material, but Boisduval's type was not among it and is apparently no longer to be found.

Melampsalta cruentata (Fabr.).

The type material in the Banksian collection is in good condition and comprises two males, one corresponding to Walker's *Cicada cincta* and the other to *M. indistincta* Myers, which as I shall show later is identical with Walker's *C. nervosa* and *C. sericea.* The excellent and appropriate description of *cruentata* by Fabricius agrees in every respect with *cincta,* and not with the second species. It is extraordinary that subsequent workers, including myself, should have confused this species after reading the description, even without seeing the type. The relevant synonymy will stand as follows,—

M. cruentata (Fabr.) nec Staal, Distant, Hutton, Kirkaldy, Myers,

Syn. *M. cincta* (Walk.) et auctt., the type of which is a normal male of moderate size.

Melampsalta sericea (Walk.), 1850, p. 169.

The type is an average female of the species described by myself (*Revision,* p. 245) as *M. indistincta.* The type of *Cicada nervosa* Walker (*Cat. Homopt. B.M.,* 1850, p. 213) is a normal male of the same species and has thus nothing whatever to do with the alpine *M. cassiope* (Huds.) which was ranged with it under the synonymy of the purely Australian *M. quadricincta* (Walk.) which again is quite distinct from either. It is hoped to figure the male genitalia of all these forms in a larger forthcoming work.

Melampsalta muta (Fabr.), Kirby (part), Distant (part), Hudson (part), Hutton, Kirkaldy; nec Myers.

The type material in the Banksian collection comprises two females,—a stout South Island example (labelled "Forster") of var. *subalpina* (Huds.), and a smaller and more typical specimen of the very common lowland form hitherto known as *cruentata* (*Revision,* p. 244). The latter agrees better with the description and is therefore to be considered the holotype. The commonest cicada of New Zealand, which has been a puzzle so long on account of its intense variability and sexual dimorphism, becomes, therefore, once more *M. muta,* as indeed it was considered until Distant restricted that name to the green varieties of the same species and at the same time extended it to include the distinct, unicolorous green species called by Hudson *Cicada aprilina,* but henceforth to be known as *M. ochrina* (Walk.).

The synonyms of *M. muta* include the following types of Walker, all of which were examined.—

Cicada rosea Walk., a large and not very dark male. Possibly a faded example of the var. *cutora* Walk.

C. angusta, a buff and blackish male, slightly pubescent and resembling examples taken by Dr. Tillyard at Mt. Cook, at an elevation of 2,500 feet.

C. bilinea, a small greenish female of the type form.

C. cutora Walk., a long-winged green female belonging to a distinct variety co-ordinate with var. *subalpina*, and to be described as such in a forthcoming paper. I suggested (*Rep. Austr. Ass. Adv. Sci.*, (1923), p. 428, 1924) that the latter was entitled to specific rank, but almost immediately afterwards a series of strictly intermediate forms was found at the Dun Mountain, Nelson, connecting it with the type.

Melampsalta ochrina (Walk.)

The type is a rather small, beautiful yellow specimen of the unicolorous green species described by Hudson as *Cicada aprilina*. This type may be either a faded specimen, or as seems from its brightness more probable to me, an example of a colour-variety which I have taken in the field and which differs from the normal only in the replacement of the green coloration by a beautiful clear yellow. Be this as it may, Walker's name unfortunately has priority and must be retained for this species. Synonyms are,—

Cicada aprilina Hudson,

M. muta Distant (part), Myers, nec Fabricius.

Melampsalta scutellaris (Walk.).

The type is a male agreeing exactly with the current conception (*Revision*, p. 242). *Cicada arche* Walk. (suggested by Kirby as a synonym of *scutellaris*), *C. telxiope* Walk. and *C. duplex* Walk. form a possibly conspecific group with no resemblance to any New Zealand species and least of all to *M. scutellaris*.

Melampsalta mangu Buchanan White.

The Buchanan White collection is in the Perth Museum in the north of Scotland. Great thanks are due to Mr. W. E. China for his care in securing a loan of some of this type material, and to the Perth and British Museum authorities for allowing me to study one of the cicadas in America. Buchanan White (*Ent. Monthl. Mag.*, v. 15, p. 214, 1879) evidently had two species before him, comprised in four examples from "Porter's Pass, Canterbury, about 3,500 feet," collected by Wakefield. The bulk of the description seems to refer to the common alpine cicada named by Hudson, *C. cassiope*, but hitherto placed in the synonymy of the Australian *M. quadricincta* (Walk.) (*Revision*, p. 246). But the only remaining material of *M. mangu* in the Buchanan White collection is a female in poor condition labelled "*mangu*" presumably in White's handwriting, and with the locality "Porter's Pass," but lacking a date. It is reasonable to suppose that this example is one of the original four, and therefore by elimination to be considered the type of *mangu*. It is not conspecific with *M. cassiope* but with a form of which I have a series from the Dun Mountain, Nelson, and which I was about to describe as new. This species was not known to me when I wrote the *Revision* (1921). Buchanan White's specimen differs only in the fact that the hind-

tibiae have a dark ring near the middle, but the leg colouration in *Melampsalta,* especially in the mountain forms, seems very variable. The larger and altogether-black species mentioned by Buchanan White at the close of his description, is probably conspecific with a third large alpine species which I have under a manuscript name.

Melampsalta cassiope (Huds.).

This, our commonest alpine cicada, distinguished at sight by the strong reddish tinge ventrally, and with very distinct male genitalia, was placed by Distant under the synonymy of *M. quadricincta* (Walk.) described from "New Holland." But the type of the latter, collected by Capt. Grey at King George's Sound, S.W. Australia, is an entirely different insect, more nearly related to *M. sericea* (Walk.) (= *M. indistincta* Myers). As might have been expected none of the European workers received specimens of our alpine cicada until long after Walker's time. Buchanan White probably had examples when describing his *M. mangu,* but as shown above his remaining material is not referable to *cassiope.* Hudson's name, *cassiope,* therefore stands,—a conclusion eminently fitting in view of his tremendous contributions towards the study of New Zealand alpine insects and their distribution.

Melampsalta lindsayi (Myers), (*Pauropsalta*).

Melampsalta maorica (Myers), (*Pauropsalta*).

On wing-venation almost alone the writer placed these two species in the genus *Pauropsalta* Goding and Froggatt, but a study of further material, and especially of the male genitalia of *lindsayi* (the other species being still represented by a female only) shows that they are undoubtedly congeneric with the other New Zealand cicadas. However congested the genus *Melampsalta* may be, the removal of these two little species into another genus would obscure their relationships.

The writer has two other species of the genus *Melampsalta* to describe. These are both montane or alpine, and show the great need for further material from such localities, not so much for the obtaining of possible further new species as for the elucidation of the races and distribution of those now known.

List of species of *Melampsalta* involved in nomenclature changes.

Valid name.	Name in *Revision,* 1921.
M. cruentata (Fabr.)	*M. cincta* (Walk.)
sericea (Walk.)	*indistincta* Myers.
muta (Fabr.)	*cruentata* nec Fabricius.
ochrina (Walk.)	*muta* nec Febricius.
mangu Buchanan White	placed as syn. of next.
cassiope (Huds.)	*quadricincta* nec Walker.

In addition, the two species *lindsayi* Myers and *maorica* Myers, referred to *Pauropsalta* in 1923 (*Trans. N.Z. Inst.,* 54, p. 431) are removed to *Melampsalta.*

CERCOPIDAE.

The types of Walker and of Adam White were examined at the British Museum, but further study is needed to elucidate them. It is hoped to revise all the New Zealand species in the near future.

CICADELLIDAE (Jassoidea).

In my " Contribution to the study of New Zealand Leaf-hoppers and Plant-hoppers " (*Trans. N.Z. Inst.*, 54, pp. 407-429, 1923) the following changes are desirable.—

p. 408. Tettigoniellinae should be Cicadellinae.

Paropiinae should be Ulopinae. None of the former subfamily is yet known from New Zealand.

The seven species placed in the genus *Diedrocephla* Spinola belong to the tribe Errhomenellini. Professor C. F. Baker, to whom I am indebted for much help and many valuable suggestions, considers that they belong or are very close to *Tylozygus* Fieber. This European genus was erected in 1866 (*Verh. z.-b. Ges.* Wien, p. 501, t. 7, f. 11) for the *Tettigonia nigrolineata* of Herrich-Schaeffer (*Panz., Faun. Germ.*, 164, 17). The type species was founded on material (one? example) said to have come from Bohemia, but Melichar (1896) in his *Cicadinen von Mittel-Europa* comments on the fact that it has never been rediscovered and suggests that the original material may have come from North America. But the genus is at present as unknown in North America as in Europe.

I have compared the New Zealand material with Fieber's careful diagnoses, both the original cited above and the amplified one in *Cicadines d'Europe,* (1875, diagnosis; 1876, figures). There are several divergences in the shape of the head and the venation, so that there may be grounds for erecting a new and endemic genus for the New Zealand forms. For the present they may, however, be left in *Tylozygus,* to which they are certainly related.

CIXIIDAE.

In my paper, " New Zealand Plant-hoppers of the family Cixiidae" (*Trans. N.Z. Inst.*, 55, 315-26, 1924), the following changes are unfortunately necessitated by an examination of the types in the British Museum and a comparison of the genitalia.

Koroana interior (Walk.).

Walker's type of *Cixius interior* is undoubtedly conspecific with my *Koroana helena* (l.c., p. 319). His *C. rufifrons* is also referable to the same species. Mr. W. E. China kindly checked both these determinations with me. The synonymy is thus as follows,—

Koroana interior (Walk.), nec Myers (*Cixius*), = *Koroana helena* Myers,
Cixius rufifrons Walk.

Cixius aspilus Walk.

The type of *C. aspilus* is now a clear testaceous of the shade which has often been originally green. It shares with the New Zealand green *Cixius* (*interior Myers,* nec Walker) the possession of very long macrotrichia conspicuous when one looks across the surface of the tegmen. These bristles are long, black, and strong and are much less developed in other species of *Cixius, Koroana,* and *Oliarus.* The genital styles are identical, and I have no hesitation in confirming Mr. Muir's identification of this with our green species, which must hence be known as *C. aspilus* instead of *C. interior.*

Oliarus oppositus (Walk.).

As suggested in 1924 (l.c., p. 324) *C. marginalis* Walk. is undoubtedly conspecific with this. The types of both species were examined. The tip of the abdomen of *marginalis* is missing, but the specimen is apparently a female, while the type of *oppositus* is a male.

COCCIDAE.

In my " Synonymic Reference List of New Zealand Coccidae " (*New Zealand Journ. Sci. Techn.,* 5, pp. 196-201, 1922) the following changes are necessary,—

p. 197. *Coelostomidia compressa* (Mask.) has been made the type of a new genus, *Platycoelostoma* Morrison, (*Proc. U.S. Nat. Mus.,* 62, p. 34, 1923).

p. 198. *Ripersia rumicis* is the type of the genus *Ripersiella* Tinsley.

p. 200. *Chionaspis dubia* Mask. belongs to the genus *Phenacaspis.*

Leucaspis cordylinidis has not been recorded from New Zealand. The reference should be to *Lepidosaphes cordylinidis* (Mask.) which is quite another species. I am indebted to Mr. G. Brittin for pointing out this error.

p. 201. *Aspidiotus carpodeti, A. buddleiae* and *A. epidendri* are all generally accepted as synonyms of *A. hederae* (Vall.).

Lepidosaphes metrosideri was made the type of the genus *Anoplaspis* Leonardi, and Morrison describes a second species, *Anoplaspis maskelli,* from New Zealand (*Proc. U.S. Nat. Mus.,* 60, p. 112, 1922).

Notes on the New Zealand Wood-wasp *Ophrynopus schauinslandi* Ashmead.

By E. S. GOURLAY, Assistant Entomologist, Cawthron Institute, Nelson.

[*Read before the New Zealand Institute Science Congress, Dunedin, 30th January, 1926; received by Editor, 5th March, 1926; issued separately, 19th February, 1927.*]

(Communicated by Dr. R. J. Tillyard, F.R.S.)

WHILE collecting at Third House near the Dun Mountain tramline, the author had the good fortune to come unexpectedly on a breeding ground of *Ophrynopus schauinslandi.*

It is situated at an elevation of about 2,000 ft., amongst dense native bush, which was burnt in 1918. Many dead trees are still standing, and having been killed mainly by heat, remain uncharred and consequently open to attack by insects. Weathering has deprived most of them of bark, and already many have succumbed to the attacks of native wood-borers, and have fallen.

From the tramway the crown of a ridge extending through this area is comparatively clear of vegetation for two hundred yards, and it is possible to work down into the standing trees for a short distance on each side. The remainder of the area is practically in accessible to the collector, being a mass of intermingled, fallen tree trunks and loose vegetation often over six feet in height. The ridge is exposed, and receives the full benefit of the sun's rays through greater part of the day, a condition well suited to the habits of *Ophrynopus.*

Previous to 1924 little was known about this insect; apart from the originally described specimen from the Chatham Islands, only four were known to the author, all of these now being in his own collection. One was forwarded by Mr. T. R. Harris from Ohakune in the North Island; another sent was secured by Mr. J. W. Campbell of Christchurch, at Blackball, Westland, and the two remaining specimens were taken by the writer on the Port Hills, Christchurch.

Unfortunately I have been unable to secure Ashmead's description of *Ophrynopus schauinslandi* and do not know the sex of his type, but the sexes are very much alike except for the well-known differences in the antennae and fore-tibiae.

Generally the fauna of the Chatham Islands may be considered to parallel that of the mainland, and it is on that supposition that the mainland species has been so determined.

Ophrynopus schauinslandi varies greatly in size, ranging from 6 mm. to 10 mm. in length, is strongly built, but is exceedingly active. By approaching standing dead trees well exposed to the heat and light of the sun, one will often observe as many as four insects on a favoured tree. The bright sunlight is preferred, few going into the shaded parts for any length of time.

In the earlier part of the mornings it is possible, with caution, to get sufficiently close to place a pill-box over the insect, and many were caught in this way. As the heat of the sun increases, they become so

extremely active that sweeping quickly up the trunk with the net must be resorted to. On alighting *Ophrynopus* invariably runs up the tree and the upward sweep becomes the only sure way of making a capture.

After a rapid flight, an insect will alight in front of the observer and commence its search for a place in which to ovipost. The insect shows much activity, ascending the tree in stages, tapping lightly with the antennae as it goes. Rapid, short runs, with antennae tapping with equal rapidity, bring it to a place selected as being suited for the act. Much minute examination of the immediate area takes place, some insects being engaged as long as a minute and a half in their survey. Finally this small space is limited to one particular spot where the individual stands, and as if to test the position to the fullest degree remains perfectly still, with the antennae now moving less rapidly, each touching the place alternately and very lightly.

There follows an interval in which the wasp shifts its position forward a little, and raising the abdomen very slightly, projects the ovipositor on to the selected spot. The form of the last abdominal sternite allows the ovipositor to assume an almost vertical position to the abdomen, and the insect moves back until this is secured. Flexing itself and using its legs to the fullest advantage in moving the body, it now, by sinuous movements, gradually introduces the ovipositor until three-quarters of its length is in the wood. Then a more gentle probing takes place, while slowly a large opalescent sac is extruded behind the ovipositor. It is almost suggestive of preparing a suitable medium in which the larva that will shortly hatch will spend the first part of its life cycle, or may possibly assist in the correct incubation of the egg, whilst there is the further possibility that this is an air sac only, used in forcing the egg down into the wood Pulsating rhythmically for about twenty seconds, the sac is finally retracted into the body, to the accompaniment of the withdrawal of the ovipositor. No force is required in freeing itself and almost immediately the active search is again resumed.

When disturbed this wood-wasp will often stand still, but more frequently jumps rapidly from the tree and flies off.

The insects associated with *Ophrynopus* are mainly other Hymenoptera, and Coleoptera. Among the Hymenoptera two solitary wasps are common, *Salius conformis* Smith and *Salius fujax* Fabricius; both are gaudy insects, and are to be found hunting spiders in the interstices of the trees.

Higher up where shot-holes caused by timber-boring beetles are numerous, *Rhopalum carbonarium* Smith, in company with *Tachytes sericops* Smith, continually search these tunnels, disappearing therein for several seconds.

The beetles are too numerous to mention in detail, but three weevils, *Psepholax sulcatus* White, *P. coronatus* White, *P. barbifrons* White, are mentioned because of their presence in proportionate numbers with *Ophrynopus*, and of the likelihood of their being possible hosts, though on the other hand it is contended that *Ophrynopus* has a wood-boring and not a parasitic larva.

In June 1925, one tree was thoroughly examined by being split into fragments, but no sign of the wood-wasp's larvae or pupae were

found, hence development probably takes place towards the late spring.

Since writing the foregoing, a specimen of *O. schauinslandi* of which the writer had no previous knowledge, has been returned to the Cawthron Institute collection. This is an example taken by Mr. A. Philpott at Greenhills, 7th January, 1920.

A List of the Lepidoptera of Deans's Bush, Riccarton, Canterbury.

By STUART LINDSAY.

[*Read before the Philosophical Institute of Canterbury, 7th October, 1925, received by Editor, 15th October, 1925; issued separately, 19th February, 1927.*]

IN company with Mr. W. Heighway, I made, during the season from October, 1924, to April, 1925, seventeen trips to the above reserve of native bush.

From this small patch of 15¾ acres I have been able to get a record of 142 species of Lepidoptera. Many of the species marked with an asterisk I have not taken previously in the neighbourhood of Christchurch, and they appear to be confined to that area, being the last survivors of the extensive swamp forest of which the bush is the only remnant.

A number of species which occur commonly in other bush-reserves on the Port Hills are, as far as I am aware, totally absent from Deans's Bush. This may be explained by the absence of a number of plants, such as manuka, tree-ferns, common tussock grass, etc., which occur in the Port Hills Bush areas. Some species are extremely abundant in the Riccarton reserve—and in their larval state must do a considerable amount of damage to the vegetation; this is very evident in the autumn, when some of the shrubs are eaten almost bare of leaves.

I do not expect the present list to be complete, as there are sure to be a few of the rarer species which we have overlooked and which may occur for a very limited season only, but it probably gives an accurate general idea of the lepidopterous fauna.

Our best thanks are due to Dr. Chilton, of Canterbury College, who supplied us with a permit to collect in the bush at night, and I am also indebted to Mr. Alfred Philpott, of the Cawthron Institute, Nelson, for identifying those species which were unknown to me.

In the following list, for the sake of brevity, I have indicated the months by numbers; many species appear to be double-brooded, occuring in spring and again in the autumn.

LIST OF SPECIES.

Leucania semivittata Walk.	10, two.
Leucania mollis Howes.	10, two.
Persectania ewingi (Westw.)	10, 11, 2, fairly common.
Persectania atristriga (Walk.)	2, not common.
Persectania steropastis (Meyr.)	12, one only.
Erana graminosa Walk.	10, 11, 2, few only.

LIST OF SPECIES.—*Continued.*

Aletia moderata (Walk.)	10, one only.
Melanchra plena (Walk.)	11, one only.
Melanchra coeleno Huds.	10, 11, several.
Melanchra diatmeta Huds.	10, one only.
Melanchra insignis (Walk.)	10, 11, 12, 2, not common.
Melanchra mutans (Walk.)	10, 1, 2, 4, fairly common.
Melanchra infensa (Walk.)	11, two only.
Melanchra ustistriga (Walk.)	2, few.
Melanchra alcyone Huds.	10, one only.
Melanchra stipata (Walk.)	10, 11, 2, common.
Ariathisa comma (Walk.)	1, several.
Rhapsa scotosialis Walk.	10 to 4, very common.
Tatosoma timora Meyr.	10, three only.
**Tatosoma topia* Philp.	10, 11, 3, in fair numbers.
Chloroclystis sandycias Meyr.	11, 12, common.
Chloroclystis muscosata (Walk.)	10 to 4, fairly common.
Chloroclystis bilineolata (Walk.)	10, very few.
Elvia glaucata Walk.	10, 1 to 4, in fair numbers.
Phrissogonus denotatus (Walk.)	2, few.
Eucymatoge gobiata (Feld.)	10, 11, 1 to 3, not common.
Hydriomena deltoidata (Walk.)	1, 2, common.
Hydriomena similata (Walk.)	11, 12, 2 to 4, fairly common.
Venusia verriculata (Feld.)	10 to 4, very common.
Venusia undosata (Feld.)	10 to 4, very common.
Asaphodes megaspilata (Walk.)	10 to 4, very common.
**Asaphodes parora* (Meyr.)	10 to 4, in fair numbers.
Xanthorhoe rosearia (Dbld.)	10, 12, 3, 4, a few only.
Xanthorhoe semifissata (Walk.)	10, few.
Xanthorhoe obarata (Feld.)	11, one only.
Xanthorhoe aegrota (Butl.)	11, one only.
Xanthorhoe benedicta Meyr.	10, 3, rare.
Xanthorhoe semisignata (Walk.)	10, 11, 12, a few at intervals.
Epirrhanthis alectoraria (Walk.)	11 to 4, fairly common.
**Selidosema argentaria* Philp.	2, 3, two only.
Selidosema leucelaea Meyr.	10, 3, two only.
Selidosema suavis (Butl.)	10 to 4, common.
Selidosema melinata (Feld.)	11 to 4, extremely common in the autumn.
Selidosema dejectaria (Walk.)	10, 11, 1, 2, common.
Selidosema panagrata (Walk.)	10, 11, 2, 4, not common.
Sestra humeraria (Walk.)	10, 11, 12, fairly common.
Declana leptomera (Walk.)	10, three only.
Vanessa gonerilla (Fabr.) *Vanessa itea* Fabr.	1, 2, 3, occasional visitors; the food plant—*Urtica ferox*—does not grow in the bush.
Chrysophanus salustius Fabr.	1, 2, 3, fairly common.
Chrysophanus feredayi Bates	1, 2, 3, fairly common.
Crambus ramosellus Dbld.	12, 1, a few in open spots.
Crambus flexuosellus Dbld.	11 to 4, very common.
Crambus tuhualis Feld.	2, several in open spots.

LIST OF SPECIES.—*Continued.*

Musotima nitidalis (Wak.)	10 to 2, common near soft bracken (*Pteris incisa*).
**Musotima aduncalis* (Feld.)	10, 11, four only.
Mecyna maorialis (Feld.)	11, one only.
Mecyna flavidalis (Dbld.)	10 to 4, extremely common.
Scoparia minusculalis Walk.	12, 1, 2, not common.
Scoparia minualis Walk.	11, 1, few only.
**Scoparia colpota* Meyr.	1, two only.
Scoparia chalicodes Meyr.	10, 11, few.
Scoparia sabulosella (Walk.)	10, 1, a few in open spots.
Scoparia petrina (Meyr.)	2, a few only.
Scoparia octophora (Meyr.)	1, one only.
Morova subfasciata Walk.	12, 4, scarce, five only.
Diplopseustis pericralis Walk.	1, one only.
Platyptilia aeolodes Meyr.	10 to 12, 2 to 4, common on outskirts of bush.
Carposina adreptella (Walk.)	2, not common.
Carposina exochana (Meyr.)	10, 11, 2, 3, 4, common in spring; few in autumn.
Catamacta gavisana (Walk.)	10, 11, 2, not common.
**Catamacta lotinana* (Meyr.)	11, 12, a few taken near *Cordyline*.
Capua plagiatana (Walk.)	10 to 4, common.
Capua semiferana (Walk.)	12, a few in open spots.
**Tortrix charactana* (Meyr.)	10, 11, 1, 2, 3, common in spring, few later.
Tortrix excessana (Walk.)	10 to 4, very common.
Tortrix flavescens (Butl.)	4, two only.
Ctenopseustis obliquana (Walk.)	10 to 4, fairly common.
Harmologa amplexana (Zell.)	10 to 12, 2 to 4, very common.
Cnephasia jactatana (Walk.)	10 to 1, not common.
Cnephasia incessana (Walk.)	11, 12, few.
**Spilonota dolopaea* (Meyr.)	10, 12, two only.
**Eucosma querula* Meyr.	11, 12, fairly common.
**Thiotricha tetraphala* Meyr.	1, one only.
Anisoplaca achyrota (Meyr.)	1, one only.
Anisoplaca ptyoptera Meyr.	3, one only.
Elachista ombrodoca Meyr.	11, 4, few in open spots.
Zapyrastra calliphana Meyr.	1, few.
Borkausenia armigerella (Walk.)	10, 11, a few on edge of bush.
Borkausenia crotala Meyr.	10, a few on outskirts of bush.
Borkausenia innotella (Walk.)	10, 12, a few.
Borkausenia chloradelpha Meyr.	10, several.
Thamnosara sublitella (Walk.)	10, 12, 2, fairly common in spring.
Gymnobathra tholodella Meyr.	2, one only.
Gymnobathra hamatella (Walk.)	1, 2, rare.
Gymnobathra flavidella Walk.	1, two only.
Gymnobathra omphalota Meyr.	10, one at night; more common by day.

List of Species.—*Continued.*

Gymnobathra cenchrias (Meyr.)	1, few.
Gymnobathra hyetodes Meyr.	3, one only.
Izatha peroneanella (Walk.)	12, 2, few only.
Izatha picarella (Walk.)	1, one only.
**Izatha attactella* Meyr.	10, one only.
**Izatha mira* Philp.	12, one female.
Izatha convulsella (Walk.)	10, common.
Izatha planetella Huds.	2, one only.
Trachypepla anastrella Meyr.	11, two only.
Trachypepla conspicuella (Walk.)	2, few.
Trachypepla contritella (Walk.)	1, few.
Trachypepla aspidephora Meyr.	1, few.
Atomotricha ommatias Meyr.	10, few.
Barea confusella (Walk.)	2, one only.
Barea ambigua Philp.	12, one only.
Euchersadaula lathriopa (Meyr.)	12, two only.
Cryptolechia liochroa (Meyr.)	11, 12, several.
Stathmopoda skelloni (Butl.)	10 to 1, common.
Stathmopoda phlegyra Meyr.	12, one only.
Glyphipteyrx achlyoessa (Meyr.)	10, 11, fairly common in open spots.
Glyphipteyrx condonias Meyr	12, 1, not common.
Gracilaria linearis Butl.	1, 3, few.
Gracilaria elaeas Meyr.	3, 4, scarce.
**Gracilaria chrysitis* Feld.	10, 4, fairly common.
**Batrachedra psithyra* Meyr.	1, fairly common; attached to *Pteris incisa.*
Batrachedra agaura Meyr.	12, 1, few.
**Orthenches glyphtarcha* Meyr.	12, 1, few.
Plutella sera Meyr.	12, 1, a few in open spots.
Plutella maculipennis Curt.	10 to 12, a few near margins of bush.
Plutella antiphona Meyr.	11, few.
Bedellia psamminella Meyr	4, one doubtful specimen.
**Hieroxestis hapsimacha* (Meyr.)	11 to 2, fairly common near *Cordyline.*
**Erechthias acrodina* (Meyr.)	10, one only.
Erechthias charadrota Meyr.	10 to 2, not common.
Erechthias fulguritella (Walk.)	10, 11, fairly common.
Eschatotypa melichrysa Meyr.	11, not common.
Eschatotypa derogatella (Walk.)	10 to 12, 2, few.
Crypsitricha mesotypa (Meyr.)	10 to 12, 2, fairly common.
Archyala terranea (Butl.)	11, two only.
Sagephora phortegella Meyr.	10, 11, not common.
Monopis ethelella (Newm.)	10, 11, 2, 4, a few on edge of bush.
Tinea mochlota Meyr.	1, few.
Lysiphragma epixyla Meyr.	11, 12, few.
Lysiphragma howesi Quail.	11, one only.
**Mallobathra fragilis* sp. n. Philp.	10, two only.

Descriptions of New Zealand Lepidoptera.

By E. MEYRICK, B.A., F.R.S.
Communicated by G. V. HUDSON, F.E.S., F.N.Z.Inst.

[*Read before the Wellington Philosophical Society, 10th September, 1925; received by Editor, 11th September, 1925; issued separately, 19th February, 1927.*]

The following material has been communicated by my esteemed correspondent, Mr. G. V. Hudson, and was captured by himself, except where otherwise specified.

PYRAUSTIDAE.

Scoparia lychnophanes, n. sp.

♀ 22 mm. Head, palpi, and thorax dark fuscous with a few whitish specks, collar mixed ochreous. Forewings moderate, rather dilated, termen little oblique; rather dark fuscous, a few scattered whitish and ochreous scales; first and second lines hardly indicated by limiting shades of scattered white-scales, posterior edge of second line more distinctly white on costa; orbicular small, round, blackish, claviform beneath it, more elongate and undefined, blackish, discal forming a small transverse light ochreous spot edged on each side with some blackish suffusion; subterminal line hardly indicated by a few white scales: cilia grey-whitish, a grey subbasal shade. Hindwings grey, somewhat darker posteriorly; cilia whitish, a grey subbasal shade.

Mount Holdsworth, Tararua Range, about 4,000 feet, in January; one specimen. Very distinct, possibly allied to *encapna.*

Scoparia pachyerga n. sp.

♂ 24 mm. Head, palpi, and thorax brown mixed dark fuscous. Forewings narrow at base, moderately dilated, termen rather oblique; brown, suffusedly mixed blackish-fuscous, tending to form thick undefined streaks between veins; first and second lines obscurely whitish, rather irregular, first rather curved, hardly oblique, edged with blackish shade posteriorly, second at $\frac{4}{5}$, nearly parallel to termen, but rather excurved on median third, edged with blackish shade anteriorly; orbicular and claviform elongate, suffused, blackish, confluent with dark margin of first line, discal suffused X-shape, blackish; subterminal line obscure, greyish, incurved in middle but not quite touching second line: cilia whitish-grey, a grey subbasal shade. Hindwings pale brassy-greyish; cilia whitish, a pale grey subbasal line.

Mount Holdsworth, in forest about 2,500 feet, in January; one specimen. Perhaps allied to *axena.*

Scoparia vulpecula n. sp.

♀ 18 mm. Head ochreous-whitish. Palpi grey, base white. Thorax light fuscous. Forewings elongate, not dilated, apex pointed,

termen oblique; light fuscous, a few scattered whitish scales; discal spot cloudy, darker fuscous: cilia whitish-fuscous, base mixed grey. Hindwings whitish-grey, greyer near termen; cilia grey-whitish.

Bold Peak, L. Wakatipu, in January; one specimen. A peculiar form; the male would probably have more ample forewings.

TORTRICIDAE.

Catamacta calligypsa Meyr.

A ♂ of this species (described from ♀ only) from Paekakariki is somewhat smaller than ♀ (15 mm.), and has grey hindwings, but otherwise does not differ particularly; the costal fold of forewings extends to $\frac{1}{3}$.

Tortrix leucaniana Walk.

A ♀ from Botanical Gardens, Wellington, which I assign to this species, has the forewings, except extreme costal edge and cilia, wholly suffused light ferruginous, with distinct black discal dot. After seeing this I am satisfied that the specimen originally described as ♀ of *Epichorista siriana* is a similar variety of *leucaniana*, and that the true ♀ of *siriana* resembles the ♂.

Cnephasia melanophaea n. sp.

♂ ♀ 18-20 mm. Head, palpi, and thorax dark fuscous, slightly speckled white, tip of patagia white, palpi rough-haired, in ♀ head and palpi mostly suffused white. Forewings slightly dilated, costa in ♂ with moderate fold on basal fourth, termen rounded, little oblique; dark purplish-grey irregularly mixed white (more strongly in ♀), a few coarse scattered blackish strigulae; markings hardly darker, but more blackish-strigulated, and more or less defined by irregular coarse black marking on edges; edges of basal patch oblique; central fascia oblique, narrow on costa, with broad triangular posterior median prominence and broad below this; costal patch represented by four small blackish costal spots and some dark suffusion connecting these beneath; a very irregular transverse blotch before lower part of termen; cilia light grey, in ♂ somewhat mixed white, in ♀ largely suffused white. Hindwings ♂ grey becoming darker posteriorly, ♀ pale grey becoming grey posteriorly, some slight darker mottling; cilia whitish-grey, more whitish in ♀, a grey subbasal line.

Mount Arthur, 4,200 feet, in January; two specimens (♂ Miss Stella Hudson, ♀ taken by Mr. Hudson six years later at same place and season, both in fine condition). Next *latomana*.

Epichorista triorthota n. sp.

♂ 14 mm. Head, palpi, thorax dark bronzy-brown. Antennal ciliations three, whorled. Forewings somewhat dilated, with slender costal fold on basal fifth, termen rather oblique; ochreous, tinged or suffused purplish-grey except towards costa; markings dark ferruginous-brown suffused dark fuscous on edges; basal patch moderate, edge straight, almost direct; central fascia moderate, somewhat narrower on dorsum, hardly oblique; an almost direct fascia from costa at $\frac{3}{4}$, moderately broad on costa but finely attenuated on dorsal half, an-

terior margin somewhat excavated above middle and edged with a whitish mark; posterior area beyond this wholly dark purplish-grey except a small ochreous costal spot beyond fascia, and an irregular ferruginous-ochreous subterminal streak: cilia ochreous, basal third and an apical spot dark grey. Hindwings dark grey; cilia light grey, basal third grey.

Sinclair stream, Wainui-o-mata, in December; one specimen. Quite peculiar.

Harmologa columella n. sp.

♂ 21 mm. Head white, a greyish bar on face, crown greyish-tinged, collar ferruginous-grey. Palpi whitish mixed grey and ferruginous. Thorax white, a transverse median band and apex of crest deep ferruginous. Forewings elongate-triangular, costa with moderate fold from base to ¼, termen nearly straight, somewhat oblique; whitish mixed light violet-grey, with some ferruginous strigulae; a moderate basal patch, with subquadrate central prominence whence a strigula connects with a spot on dorsum before middle; central fascia moderately broad, rather oblique; costal patch represented by four dark violet-grey spots and an elongate-triangular violet-grey and ferruginous suffusion connecting them beneath; an erect fasciate evenly broad and straight-edged streak from tornus nearly reaching this: cilia pale grey. Hindwings grey, somewhat darker posteriorly; cilia grey.

Arthurs Pass, about 4,000 feet, in January (Miss Stella Hudson); one specimen; stated to occur also on Mount Arthur. Next *sanguinea.*

OECOPHORIDAE.

Borkhausenia ancogramma Meyr.

A fine example from Wainui-o-mata shows a well-marked subdorsal tuft on forewings before middle, and thoracic crest; I am not disposed, however, at present to separate it generically from *Borkhausenia,* to some forms of which it is in all other respects closely related, but the structures should be noted.

Corocosma n. g.

Head with appressed scales; ocelli posterior; tongue developed. Antennae ⅘ (in ♂ probably with long ciliations), basal joint moderate, with narrow pecten. Labial palpi moderate, curved, ascending, slender, second joint loosely scaled beneath, terminal joint shorter than second, pointed. Maxillary palpi rudimentary. Thorax with posterior crest. Posterior tibiae rough-scaled above, with whorls of projecting scales on origin of spurs. Forewings with large tufts of scales on surface; 1b furcate, 2 from near angle, 7 absent, 11 from middle. Hindwings under 1, elongate-ovate, cilia 1; 3 and 4 connate, 5-7 somewhat approximated towards base.

A new form of unusual interest, allied to the remarkable Australian genus *Petalanthes,* of which it appears to be a development, differing in the absence of vein 7, and reduction of terminal joint of palpi; it belongs to the group of *Trachypepla.* I infer, therefore, that it is to be included in that portion of the New Zealand fauna which immigrated from Queensland by way of New Caledonia.

Corocosma memorabilis n. sp.

♀ 8 mm. Head whitish, crown sprinkled grey. Palpi whitish. Thorax brownish sprinkled dark grey. Forewings suboblong, apex obtuse, termen slightly rounded, oblique; brown; a transverse streak of blackish irroration near base, beyond this a fascia of dark grey and whitish irroration, including two successive white spots in disc; plical and first discal stigmata represented by two spots transversely placed of raised blackish scales suffused coppery and tipped prismatic-metallic, above these a blackish spot on costa followed by slight whitish irroration; irregular narrow angulated fasciae of dark grey and whitish irroration crossing wing beyond middle and at ⅘, connected on costa, between these a curved transverse streak of raised blackish scales in disc, immediately beyond second a white spot on costa; a marginal streak of dark grey and whitish irroration round posterior part of costa and termen, preceded by an irregular blackish streak; cilia fuscous with strong, coppery-metallic reflections, a blackish subbasal line. Hindwings dark grey; cilia grey, a dark fuscous subbasal line.

Shedwood Forest, Tapawera, January (Miss Stella Hudson); one specimen. This seemingly obscure but really beautiful little insect (the smallest of the 154 New Zealand *Oecophoridae*) is probably adapted by its complex marking and rough scaling for concealment on tree-trunks, and by its bright metallic and coppery ornamentation for flying in sunshine, both these habits being characteristic of the species of *Petalanthes* also.

Trachypepla indolescens n. sp.

♂ 18 mm. Head white. Palpi white, second joint grey except apex, terminal joint grey anteriorly. Antennal ciliations 1. Thorax light grey, sides of metathorax and patagia except shoulders white. Forewings with costa moderately arched, apex obtuse, termen very obliquely rounded; brownish-grey; a rather narrow suffused white angulated fascia about ⅓; stigmata forming small cloudy dark fuscous spots, plical hardly beyond first discal, these adjoining preceding fascia; a broad suffused white fascia preceding second discal, in disc extended anteriorly by broad white suffusion to touch stigmata; beyond this the posterior area suffused white except a line of ground colour from costa at ⅔ to tornus, excurved in disc and indented towards costa; a marginal series of triangular dark fuscous dots round posterior part of costa and termen: cilia fuscous-whitish. Hindwings light grey; cilia ochreous-whitish.

Karori, Wellington, February; one specimen. This is in very good condition and shows no apparent raised scales, but seems to be truly allied to *photinella,* in which they are very slightly developed; it is therefore probably assignable to *Trachypepla.*

Proteodes melographa n. sp.

♂ 21 mm. Head white, a dark fuscous bar on face. Palpi white suffusedly mixed dark grey. Thorax white, patagia suffused dark grey except tips. Forewings moderate, posteriorly dilated, termen straight, rather oblique; white, irregularly sprinkled grey, unevenly strewn with blackish or dark brown dots, tending to form longitudinal or transverse series; some ferruginous suffusion towards base of costa;

a small dark fuscous spot on costa at ⅓, whence a fine rather curved dark fuscous stria runs to dorsum, adjoining this posteriorly a suffused feruginous spot in disc and some grey marbling towards dorsum; a transverse brown-whitish mark on end of cell edged anteriorly with a few black scales, and posteriorly with dark grey suffusion, beyond this a transverse fascia of grey marbling obscurely interrupted below middle, becoming darker and broader towards costa, on which it forms three or four small spots; some slight brownish suffusion near termen; a terminal series of blackish marks; cilia grey-whitish, base barred white, a dark grey subbasal and pale grey postmedian line. Hindwings whitish-grey; a light grey spot on end of cell; cilia whitish, basal half faintly barred greyish.

Mount Arthur, 4,000 feet, in January (Selwyn Woodward); one specimen. This, the third species of the endemic genus *Proteodes,* is very distinct and interesting.

Lathicrossa prophetica n. sp.

♂ 16 mm. Head whitish with a few blackish scales. Palpi whitish sprinkled blackish, terminal joint with broad blackish band. Thorax pale pink mixed dark grey. Forewings somewhat dilated, apex obtuse-pointed, termen faintly sinuate, oblique; light rose-pink suffusedly mixed dark grey; a small black spot on base of costa, and one just beyond and beneath it; stigmata forming small black spots, plical obliquely beyond first discal and rather smaller, each of these followed by a white dot, second discal subquadrate; the pink ground-colour forms small distinct spots on costa at middle and ¾ between patches of dark suffusion: cilia grey mixed pinky-whitish, base rose-pink. Hindwings grey finely irrorated blackish-grey; cilia grey, basal third blackish-grey.

Mount Arthur, about 3,500 feet, in January (Selwyn Woodward); one specimen.

COSMOPTERYGIDAE.

Thectophila n. g.

Head smooth; ocelli posterior, tongue developed. Antennae (partly broken), basal joint elongate, rather dilated towards apex, without pecten (?). Labial palpi, very long, recurved, slender, smooth, terminal joint as long as second, acute. Maxillary palpi obsolete. Posterior tibiae clothed with hairs above. Forewings with 1b simple, 2 from angle, 2-4 parallel, 5 absent, 6 and 7 out of 8, 7 to costa, 11 from middle. Hindwings ⅜, lanceolate, cilia 3; 2-4 parallel, 5 absent, 6 and 7 stalked.

Apparently a development of *Pyroderces.*

Thectophila acmotypa n. sp.

♀ 14 mm. Head, thorax ochreous-whitish (rubbed). Palpi whitish. Forewings lanceolate, apex acutely produced, caudulate; ochreous-whitish; a fine dark grey line from disc at ⅜ to apex, terminating in a black apical dot: cilia ochreous-whitish, round apex short segments of blackish subbasal and grey postmedian lines. Hindwings pale grey; cilia whitish.

Arthur's Pass, 4,000 feet, in February; one specimen.

Glyphipterygidae.

Heliòstibes vibratrix n. sp.

♀ 16 mm. Head and palpi fuscous. Thorax rather darker bronzy-fuscous. Abdomen dark fuscous, ventral surface pale yellow. Forewings suboblong, termen hardly oblique; fuscous, with numerous irregular transverse cloudy dark purplish-fuscous striae; second discal stigma forming a small transverse dark fuscous spot; two slight whitish marks on dorsum about middle: cilia fuscous. Hindwings blackish-grey; cilia grey, basal third dark fuscous.

Mount Arthur, 4,000 feet, in January, one specimen. Not in good condition, but quite a peculiar species.

Lyonetiadae.

Erechthias lychnopa n. sp.

♂ 15 mm. Head, thorax greyish mixed darker. Palpi grey mixed blackish, beneath whitish. Antennae grey tinged fulvous on basal half. Forewings grey irregularly irrorated blackish scales finely edged whitish; a white mark on middle of costal edge; upturned apical area with median portion dark grey mixed blackish and speckled white, above and below this triangular light orange-ochreous spots, line of flexure with whitish reflections: cilia grey-whitish with blackish subbasal and postmedian shades, above apex a blackish external hook. Hindwings dark grey, an apical spot of whitish speckling; cilia grey, round apex whitish-tinged with three dark grey lines.

Karaka Grove, near Sinclair Head, Wellington, in November; one specimen. Near *externella*, but apparently quite distinct.

N.Z. Lepidoptera: Notes and Descriptions.

By ALFRED PHILPOTT, Hon. Research Student in Lepidoptera, Cawthron Institute, Nelson.

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NOLIDAE.

Celama parvitis (Howes). *Trans. N.Z. Inst.*, vol. 49, p. 274.

The type specimen of this interesting species was taken by Mr. C. E. Clarke at Broad Bay, Dunedin, in December, 1915. Mr. Howes, who described it, placed it in *Adeixis*, to which genus it has considerable superficial resemblance. A second specimen was found in the collection of the late M. O. Pascoe, which is now the property of the Southland Museum, Invercargill. In December, 1924, the writer took a third example at Aniseed Valley, Nelson. The venation and mouth-parts of this specimen were critically examined, and the insect proved to belong to the genus *Celama*, of the family Nolidae, a most interesting addition to the New Zealand fauna. The Nolidae, which some authorities treat as a sub-family of the Arctiidae, are well represented in Australia, but Dr. A. J. Turner, to whom *C. parvitis* was submitted, did not recognise it as an Australian form, so that our species is in all probability endemic.

NOCTUIDAE.

Aletia funerea n. sp.

♀. 37 mm. Head grey with a broad blackish longitudinal stripe on each side of median pale line. Palpi grey, third segment thin, moderately long and very slightly swollen towards apex. Antennae brown, mixed with grey on basal half. Thorax grey with a Λ-shaped fuscous mark. Abdomen pale fuscous. Legs fuscous grey, tarsi annulated with blackish. Forewings, costa almost straight, apex rectangular, termen very little oblique, rounded beneath; whitish-grey; markings black or blackish-fuscous; an interupted double angled line near base; a similar line at ¼, connecting with median band in disc; a broad median band (its posterior margin indistinctly serrate) enclosing orbicular; orbicular well-defined, grey, suboval; reniform rather small but of normal shape; a subterminal band, broadly interrupted above and below middle; a series of semicircular dots round termen: fringes greyish-brown with some white scales. Hindwings fuscous: fringes fuscous, apical half white.

The form of the palpi shows this species to be allied to the *longstaffi* group, but it is a larger and more definitely marked insect.

Mount Arthur Tableland in January. A single female taken at night at an elevation of about 4500 ft. Type in coll. Cawthron Institute.

Anomis sabulifera Guen., Noct., vol. 2, p. 404.

A single specimen of this well-known and widely spread species came to a lighted window in Nelson about the middle of March last. Dr. A. J. Turner informs me that it occurs in most parts of Australia. It is also known from the Malay Archipelago, India, and Africa.

Cosmophila flava (Fabr.), *Syst. Ent.*, p. 601 (1775).

In 1910 Mr. W. G. Howes took a male specimen of this Australian moth in Wellington. This he kindly gave to the writer, but it was not recorded as there was a doubt as to whether it had been reared from imported material or taken in the field. It now appears that Mr. E. S. West, of Napier, captured a female of the same species at Otahuhu, Auckland, in January, 1907, and through the kindness of Mr. G. V. Hudson I have been able to examine this example. In all probability both these specimens were accidentally introduced, and as it is fifteen years since the last specimen was taken it is unlikely that the species has become established.

Mocis alterna Walk., *Cat. Het.*, vol. 15, p. 1833.

This also is a familiar Australian insect, with a range to New Guinea, China, and Japan. Dr. Turner gives the Australian distribution as North Australia, North West Australia and Queensland. On 26th February, 1925, a specimen, in rather worn condition, was attracted to the lights at the Cawthron Institute.

HYDRIOMENIDAE.

Chloroclystis heighwayi n. sp.

♂. 23-24 mm. Head, thorax and abdomen greyish-pink mixed with fuscous and black. Palpi 2, fuscous-grey with some white scales above. Antennae fasciculate-ciliate, greyish-pink annulated with fuscous basally, ciliations $3\frac{1}{2}$. Legs ochreous-grey, densely irrorated with fuscous, tarsi annulated with ochreous-grey. Forewings triangular, costa slightly arched basally, subsinuate at middle, apex round-pointed, termen slightly bowed; pinkish-grey densely irrorated with fuscous; veins blackish; a series of very obscure darker irregular transverse lines, here and there margined with whitish, more pronounced at $\frac{1}{4}$, before $\frac{1}{2}$, and $\frac{3}{4}$; an indistinct serrate subterminal line, interrupted above dorsum; a black line round termen: fringes pinkish-grey with median white line and indications of dark bars. Hindwings, termen moderate, sinuate below apex and above tornus leaving a broad blunt median projection; colour as in forewings but markings still more obscure; a dark discal dot: fringes as in forewings.

A most obscure and difficult form to describe satisfactorily. Near *C. bilineolata* Walk., but without the green tinge and definite markings of that species.

Pukeatua Bush, Port Hills, Canterbury. Nine males taken by Messrs. W. Heighway and S. Lindsay during the last week of September. Type and paratypes in coll. W. Heighway; two paratypes in coll. S. Lindsay.

SELIDOSEMIDAE.

Selidosema campbelli n. sp.

♀. 45 mm. Head smoke grey, ochreous behind, frons purplish-fuscous. Palpi purplish-fuscous, ochreous beneath. Antennae, shaft ochreous, pectinations black, 3½. (The pectinations appear to be much shorter than they are owing to their acute angulation with the shaft). Thorax (denuded). Abdomen greyish-ochreous. Legs ochreous, anterior pair infuscated and tarsi broadly banded with fuscous. Forewings elongate-triangular, costa moderately and uniformly arched, apex obtuse, termen bowed; basal fifth ochreous sprinkled with fuscous; a broad median band of fuscous-black mixed with ochreous, its anterior margin almost straight, its posterior margin with a broad blunt median projection; following the median band a broad area of white, slightly tinged with ochreous and traversed by a number of short fuscous strigae from costa; termen broadly fuscous, more narrowly towards tornus: fringes fuscous mixed with ochreous. Hind-wings bright ochreous sprinkled with fuscous on basal and dorsal areas: fringes ochreous mixed with fuscous, clear ochreous round apex.

Not closely related to any other New Zealand species of the genus. As far as I am aware, pectinated antennae in the female are found in one other species only, *S. dejectaria* (Walk.).

Blackball, Westland. The unique specimen was taken in December by Mr. J. W. Campbell who very kindly presented it to the Cawthron Institute.

CARPOSINIDAE.

Carposina maculosa n. sp.

♂ ♀. 18 mm. Head, antennae and thorax light buff. Palpi light buff mixed with ochreous on lower half externally. Abdomen ochreous-white. Legs ochreous-white, anterior and middle parts infuscated. Forewings moderate, costa moderately arched at base, thence straight, apex subacute, termen straight, oblique; light buff finely irrorated with pale fuscous; markings fuscous-black; a dot beneath costa near base and a similar one obliquely before it above dorsum; a minute dot beneath costa at ¼ and a much larger one beneath it below fold; a dot in disc beyond these; a dot beneath costa and two below it in disc before ½; a small dot beneath costa between these and ¾; two or three dots touching each other and forming a short transverse striga at ¾; an obscure irregular striga from costa at ⅘ to tornus; a series round termen: fringes whitish-buff. Hindwings and fringes shining white.

The series of distinct dots which forms the markings of this species easily separates it from other members of the genus. The ground colour is also distinctive, though *C. charaxias* Meyr. approaches it in this respect.

Hoon Hay Bush and Cooper's Knobs, Port Hills, Canterbury. The first specimen was taken by Mr. S. Lindsay in 1923 and subsequently several others were taken by Messrs. Lindsay and Heighway. Holotype (♂), Allotype (♀) and several paratypes in coll. W. Heighway.

GELECHIIDAE.

Phthorimaea quieta n. sp.

♂ ♀. 10-12 mm. Head, antennae and thorax grey. Palpi grey, second segment infuscated externally and apical segment with suffused subapical fuscous ring. Abdomen brown, segmental divisions whitish-grey. Legs fuscous, tibiae and tarsi annulated with ochreous-white. Forewings long, costa hardly arched, apex rounded, termen very oblique; greyish-white densely irrorated with fuscous and with a few ochreous scales; the fuscous irroration tends to form a series of obscure markings as follows:—an outwardly oblique fascia near base, reaching to fold; a similar fascia at about $\frac{1}{4}$; a large semioval suffused blotch on middle third of costa; two or three suffused fasciae on apical $\frac{1}{4}$: fringes pale fuscous-grey dotted with dark fuscous. Hindwings pale greyish-fuscous: fringes pale fuscous-grey tinged with ochreous.

Near *P. thyraula Meyr.* but I think quite distinct.

Bottle Lake, Christchurch. Mr. S. Lindsay took several in October and February. Holotype (♂), allotype (♀) and two paratypes in coll. S. Lindsay.

OECOPHORIDAE.

Borkhausenia marcida n. sp.

♂ ♀. 15-17 mm. Head, palpi and thorax brownish-grey. Antennae brown annulated with grey, ciliations in ♂ 1. Abdomen bronzy, mixed with grey basally, segmental divisions grey. Legs brown mixed with grey. Forewings moderate, costa moderately arched, apex rounded, termen very oblique; white, densely irrorated with pale bronzy-brownish; markings sometimes entirely absent but usually a spot of paler or brighter bronzy brown beneath fold at $\frac{1}{3}$ and a similar spot in disc at $\frac{2}{3}$, a spot on costa at $\frac{2}{3}$ and another on tornus; dorsal spots margined posteriorly with white: fringes concolorous with wing, tips darker. Hindwings pale greyish-fuscous: fringes fuscous-grey with dark basal line.

A very obscure member of the *brachyacma* group. The frequent absence of markings makes its identification difficult but there are good genitalia characters.

Bottle Lake, Christchurch; Governor's Bay and Mount Grey. Collected by Mr. S. Lindsay in September and October. Holotype (♂), allotype (♀) and several paratypes in coll. S. Lindsay.

Borkhausenia paula n. sp.

♂. 11-12 mm. Head, palpi and thorax pale ivory-yellow. Antennae fuscous with pale dots, ciliations slightly more than 1. Abdomen dark purplish-grey. Legs ochreous-whitish mixed with pale brown. Forewings blunt lanceolate, costa moderately arched,

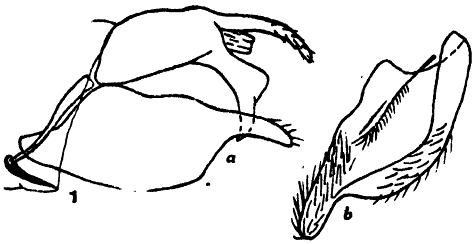

FIG 1.—*Borkhausenia paula* n. sp. *a*, male genitalia, lateral view; *b*, harpes, from within.

FIG. 2.—*Borkhausenia marcida* n. sp. *a*, male genitalia, lateral view; *b*, harpes, from within; *c*, harpes, ventral view.

apex round-pointed, termen very oblique; pale ivory-yellow; extreme edge of costa near base fuscous; fringes concolorous with wing. Hindwings dark fuscous: fringes greyish-fuscous: fringes greyish-fuscous with darker basal line.

A very small and inconspicuous species. Near *B. maranta* Meyr. but with less pointed forewings.

Pukeatua Bush, Port Hills, Canterbury. Two males taken by Mr. S. Lindsay in November. Type and paratype in coll. S. Lindsay.

Gymobathra caliginosa n. sp.

♂. 16-18 mm. Head ochreous-whitish-brown. Palpi and antennae ochreous-white, densely mixed with fuscous-black, antennal ciliations extremely short. Thorax brown. Abdomen brassy-brown, segmental divisions slate-brown, anal tuft ochreous. Legs fuscous, hair of posterior tibiae ochreous, tarsi annulated with whitish-ochreous. Forewings rather long, costa moderately arched, apex obtuse, termen rounded, little oblique; pale brown, more or less mixed with blackish-fuscous: markings very obscure; blackish-fuscous; first discal spot at $\frac{1}{3}$; plical obliquely beyond first discal and connected with it by a bar: second discal at about $\frac{1}{2}$; sometimes an obscure, interrupted, transverse line at $\frac{2}{3}$; a very obscure whitish subterminal line, sometimes absent; fringes ochreous with two brown bands. Hind-wings fuscous-grey: fringes ochreous with brown basal line.

In one example the forewing is strongly suffused with ochreous, especially along costa. Related to *G.cenchrias* (Meyr.) but a darker and more obscure form. The genitalia of the male offer good distinguishing characters, and the antennal ciliations are shorter.

Cooper's Knobs, Port Hills, Canterbury. Four males taken by Mr. S. Lindsay in November. Holotype (♂) and two paratypes in coll. S. Lindsay and one paratype in coll. W. Heighway.

TINEIDAE.

Tinea lindsayi n. sp.

♂. 11 mm. Head dark bronzy-brown, frons white. Maxillary palpi white. Labial palpi bronzy-brown, terminal segment white. Antennae grey annulated with black. Thorax and abdomen dark purplish-fuscous. Legs greyish-fuscous, tarsi annulated with ochreous-white. Forewings elongate, parallel-sided, costa slightly arched, apex obtuse, termen straight, oblique; leaden-grey; numerous transverse irregular fuscous-black fasciae; space between fasciae, particularly on apical half, filled with bright bronzy-brown: fringes fuscous with a mixed bronzy and dark fuscous basal line. Hindwings dark purplish-fuscous: fringes dark greyish-fuscous.

The white frons is sufficient to distinguish the species from any other *Tinea.* It is possible that it is not correctly assigned to *Tinea,* but only one example was available for examination.

Mount Grey. A single male taken by Mr. S. Lindsay, in whose collection the type remains.

Mallobathra fragilis n. sp.

♂. 9-10 mm. Head and thorax light bronzy-fuscous. Palpi whitish. Antennae whitish-grey, ciliations slightly over 1. Abdomen dark bronzy-fuscous. Legs greyish-fuscous. Forewings long, narrow, costa hardly arched, apex rounded, very oblique; whitish-grey irrorated with pale fuscous; a dark fuscous margining on costa from base to $\frac{1}{4}$; a dark fuscous spot on costa at $\frac{1}{2}$; a similar spot on costa at about $\frac{3}{4}$; three or four oblique fuscous fasciae from costa to termen on epical fifth: fringes grey. Hindwings and fringes pale fuscous grey.

Resembles *M. araneosa* Meyr. but is considerably larger than that species.

Dean's Bush, Riccarton, Christchurch. Two males secured by Mr. S. Lindsay in October. A third male was taken, also in October, by the writer on the Dun Mountain track at about 2,000 ft. Type and paratype in coll. S. Lindsay; paratype in coll. Cawthron Institute.

COSSIDAE.

Xyleutis boisduvali Roths., *Novit. Zool.,* 1896, p. 232.

A female specimen of this huge species, probably the heaviest moth in the world, was taken at Spring Grove, Nelson, in February, 1925. It had emerged from one of the Australian hardwood poles used by the Telegraph Department. Several of the smaller species, *X. eucalypti* Boisd., have been reported from various parts of the Dominion during the last few years, and it is probably only a matter of time before one or more Cossids become established in the country.

HEPIALIDAE.

Porina leonina n. sp.

♂. 63 mm. Head tawny. Antennae dull orange, strongly bipectinated. Palpi dark brown, apex tawny. Thorax rather dark brown with an anterior pale bar. Abdomen dull brown. Legs tawny. Forewings moderate, broad, apex broadly rounded, termen bowed, oblique; rich dark brown with some blotches of fuscous-black; a series of short irregular white strigulae beneath costa from base to $\frac{2}{3}$; on dorsal fourth, from middle to margin, several vermiculate white markings; a white-margined dark dot on dorsum at $\frac{1}{3}$; a tawny band, margined with whitish before and behind, from costa at $\frac{3}{4}$ to dorsum before tornus: an indistinct subterminal line enclosing some dark dots: fringes tawny barred with fuscous-black. Hindwings tawny: fringes as in forewings.

Belongs to the group with strongly bipectinated antennae but is easily distinguished from its allies.

Salisbury's Opening, Mount Arthur Tableland, at about 4,000 ft. The unique specimen was taken on 4th April. Type in coll Cawthron Institute.

MNESARCHAEIDAE.

Mnesarchaea fallax n.sp.

♂. 10 mm. Head, palpi and antennae bronzy-brown. Thorax and abdomen purplish-brown. Legs greyish-fuscous. Forewings lanceolate, costa moderately arched; bronzy-brown; a white triangular spot with a few white scales above it on tornus; a few white scales beneath costa at $\frac{4}{5}$ and along termen: fringes bronzy-brown, white on tornus. Hindwings fuscous with purplish-violet sheen apically: fringes greyish-fuscous.

Superficially like *M. fusca* Philp, but a larger species. Figures of the male genitalia are given elsewhere in this volume.

Mount Arthur Tableland. Two males in December at an elevation of 4,500 ft. Type in coll. Cawthron Institute.

The Genitalia of the Mnesarchaeidae.

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PLATE 57.

THE Mnesarchaeidae are a small and highly specialized endemic family of the Lepidoptera Homoneura. At present the group consists of the type genus only, of which six species have been described. These are here tabulated in the order of the publication of their descriptions.

Mnesarchaea paracosma Meyr., *Trans. N.Z. Inst.*, vol. 18, p. 180 (1886).

Mnesarchaea loxoscia Meyr., *Trans. N.Z. Inst.*, vol. 20, p. 90 (1888).

Mnesarchaea hamadelpha Meyr., *Trans. N.Z. Inst.*, vol. 20, p. 91 (1888).

Mnesarchaea fusca Philp., *N.Z. Journ. of Sci. and Tech.*, vol. 5, p. 82 (1922).

Mnesarchaea similis Philp., *Trans. N.Z. Inst.*, vol. 55, p. 667 (1924).

Mnesarchaea fallax Philp. This volume (1926).

The group presents very striking differences in the male genitalia characters, abundantly sufficient, indeed, to justify generic division in the opinion of those systematists who attach primary importance to these structures. But, though the six species fall into three very well-defined sections based on the characters of the male genitalia, I have not found that other structural characters satisfactorily support such divisions. For instance, *hamadelpha, loxoscia,* and *similis* have all the same type of genitalia and are obviously nearly related species, yet in venation the latter two are closer to *paracosma,* which has an altogether different type of genitalia, than to *hamadelpha*. Again, *M. paracosma* is nearer in genitalia characters to *M. fusca* than to *M. fallax,* but in venation *M. paracosma* and *M. fallax* are seen to resemble each other most nearly.

DESCRIPTION OF THE MALE GENITALIA.*

Owing to the marked differences between the species it is not practicable to give a general description of the genitalia characters. It may be noted, however, that the juxta is absent in all the species, and that the aedeagus consists only of the membranous ductus ejaculatorius. The species will now be considered separately.

Mnesarchaea hamadelpha Meyr.

Vinculum well developed, broadly U-shaped, upper angles rather produced. Harpes, sacculus triangular, armed within with a dense median patch of short hair and some more scattered hairs on the apical portion; cucullus as long as sacculus, finger-like, abruptly contracted into a fine point at apex, a few hairs along inner surface. The tegumen is represented by a pair of weakly chitinized flat lobes, the apical portions of which are rather hairy. These lobes curve towards each other apically and thus, in some measure, protect the anal tube. From the lower part of the lobes there is a curved extension inwards, which meets and fuses completely on the median line, forming a concave plate beneath the penis. Eyer has termed a somewhat similar organ in the Hepialidae a "suspensorium" and I adopt his name. The upper part of this structure is extremely strongly chitinized—a condition well shown in the photograph—and on the upper margin is a well-marked median incision. Behind this plate lie the anal and genital openings, the latter having two longitudinal spiny areas (cornuti) beneath it. The uncus is absent, as is also any chitinization representing the dorsal portion of the tegumen.

Mnesarchaea similis Philp.

Vinculum broad, quadrate, with produced upper angles. Harpes, sacculus triangular but curved scroll-wise in normal position, armature similar to that of *hamadelpha,* cucullus nearly as long as sacculus, finger-like, apex truncate and slightly expanded. Suspensorium somewhat heart-shaped, it's apex widely and deeply emarginate, round the emargination the edge is irregular and more strongly chitinized. Beneath this stronger chitinization, in a median position, there is a rather large circular aperture.

Mnesarchaea loxoscia Meyr.

Vinculum intermediate between those of *similis* and *hamadelpha.* Harpes, sacculus bluntly triangular, smaller than in the two preceding species, cucullus slightly longer than sacculus, rather narrow at

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*In the present paper I have made some changes in the nomenclature of the parts formerly used by me, following in the main the system adopted by Eyer in the publication cited below. I here indicate these changes. Vinculum = the ninth sternite. Harpes = the clasping organs which articulate within the vinculum; formerly termed valvae. Sacculus = the lower lobe of the harpes; cucullus = the upper lobe of the harpes; frequently the harpes are not divided into these two parts. Aedeagus = the central organ which encloses the usually membranous penis. Penis = the continuation of the ductus ejaculatorius, ending in the eversible vesica.

base, thence slightly dilated, apex obtuse. Suspensorium subquadrate, broad basally, upper angles produced, a strongly chitinized band along upper margin, broadest at middle and narrowing rapidly to angles. Lobes of tegumen shorter and broaded than in the preceding species, apices broadly round-pointed.

Mnesarchaea paracosma Meyr.

The three species already dealt with illustrate varieties of a common type, but in *paracosma* we come to a widely different development of the organs. This species provides a very interesting example of asymmetry in genitalia structure, the two sides of the tegumen, the uncus, and the anal tube being the parts affected. Vinculum broad, but widely and deeply emarginate basally; from the median distal area two strong processes project beneath the harpes. Harpes, sacculus an irregular lobe with an armature of weak scattered hairs, cucullus finger-like, curved closely round apex of sacculus. From the base of the harpes, and membranously attached thereto, a narrow chitinous piece engages with the base of the suspensorium. This may be regarded, probably, as originally the lateral part of the vinculum which, owing to the throwing back of its attachment to the lower part of the tegumen, developed a convenient hinge at the most suitable point. Suspensorium enormously developed, projecting basally as a swollen lobed structure and distally as two long thin prongs which exceed in length the other parts of the genitalia. Tegumen consisting of left and right asymmetrical pieces, not fused dorsally. These pieces project in the general line of the body as thin stiff prongs. That on the left is fairly straight but the right prong is sharply angled outwards near its base, after which it resumes its original direction. This bend throws it quite clear of the rest of the genitalia, as is well shown in the dorsal and ventral views of the organs. Rising from where the lateral pieces of the tegumen approach each other dorsally, a thin curved prong, of about the same length as the prongs of the tegumen, bends over to the left. This I take to be a development of the dorsal portion of the tegumen and its curved apical part may be regarded as the uncus. The anal tube is attached to this apical part and is thus carried over to the left also, clear of its usual position in the median line.

Mnesarchaea fusca Philp.

Mnesarchaea fusca exhibits a type of genitalia structure quite different from that of any of the preceding species. The vinculum is shield-shaped. The harpes consist of a short, three-lobed outer piece and a low rounded basal extension inwards. From the base there proceeds a flat lateral piece which articulates loosely with the tegumen, thus taking on the function of the lateral arms of the vinculum. It will be seen, from the lateral view of the genitalia, that the vinculum, in this instance, could not without extreme modification carry out the function referred to. The tegumen has become a horizontal structure, its basal part deeply embedded in the abdomen and its apex divided into two strongly chitinized diverging prongs. These prongs apparently function as the uncus, but are probably

not homologous with that part in other Lepidoptera. Ventral of the tegumen is a membranous triangular plate supported by chitinized lateral rod-like pieces, which fuse basally with the ventral surface of the tegumen. This may be regarded as an outgrowth of the tegumen, a but slightly chitinized suspensorium. Between it and the uncus is the anal outlet, but there is here no extruded anal tube.

Mnesarchaea fallax Philp.

Vinculum large, lateral pieces broad and tapering to a blunt point. Harpes, sacculus short, broad, rounded; cucullus finger-like, stout, curved completely over apex of sacculus, apical half very strongly chitinized and bearing a number of short hairs. The tegumen appears to have taken up a horizontal position as in *M. fusca*. It forms a pair of lateral pieces to a weakly chitinized deeply bifid central structure, which appears to be a development of the closing membrane into a false gnathos. The anal tube lies immediately above this structure and there is no uncus or chitinized dorsal part.

Only one specimen of this species was available for dissection, and the conclusions must therefore be regarded as tentative.

THE FEMALE GENITALIA.

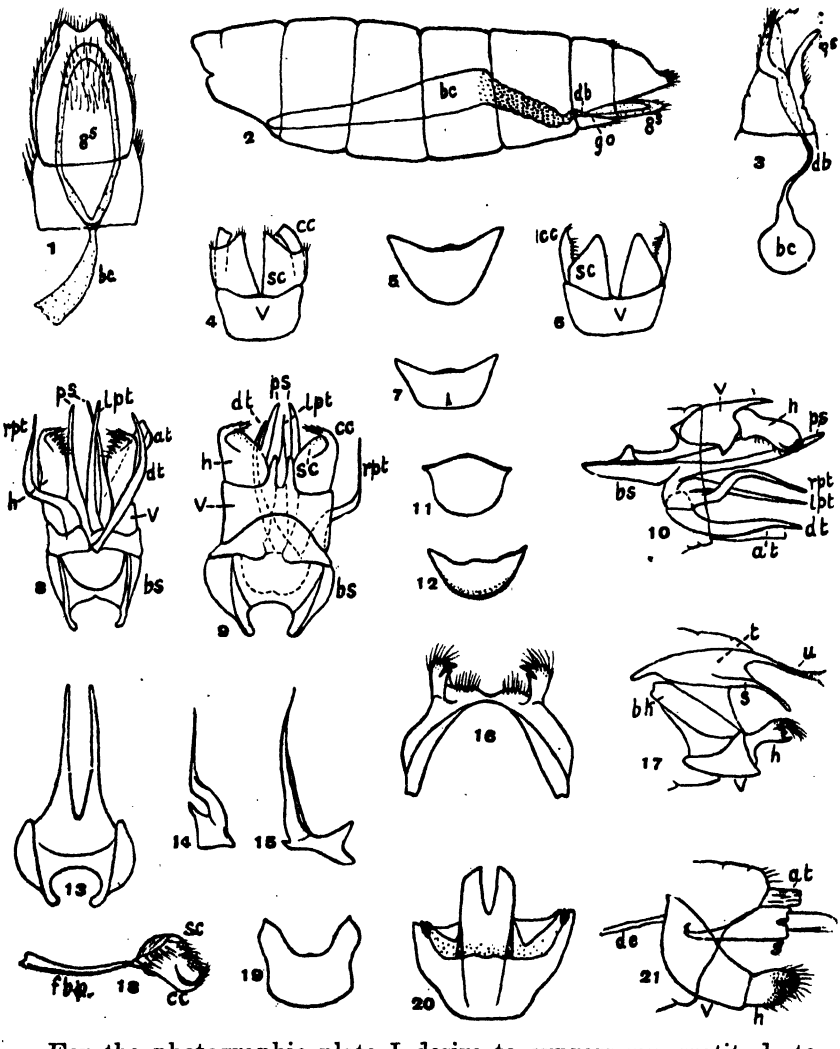
As the females of this genus are much more rarely taken than the males, I have only been able to secure material of two species for examination. These two, however, differ considerably, and require separate description. The abdomen consists of a very much reduced first segment, followed by six normal ones. In *Mnesarchaea hamadelpha* Meyr. the eighth sternite takes the form of a curved ventral plate, the basal part of which extends back into the seventh. The ductus bursae opens in the concavity of this piece. Above lies the eighth tergite, to which succeeds the not clearly separated ninth. Apically the ninth is slightly bifid and incurved. The ductus bursae is short and merges into the tube-like bursa copulatrix, which extends almost to the base of the abdomen, its apical third being minutely scobinate.

In *Mnesarchaea fusca* Philp. the terminal tergite is much narrower than in *Mnesarchaea hamadelpha;* it is also more indented in the median line, forming two strongly chitinized hairy lobes. The eighth sternite is broad, apically somewhat indented and curved slightly downwards. The ductus bursae is a rather fine tube well defined from the globular bursa copulatrix.

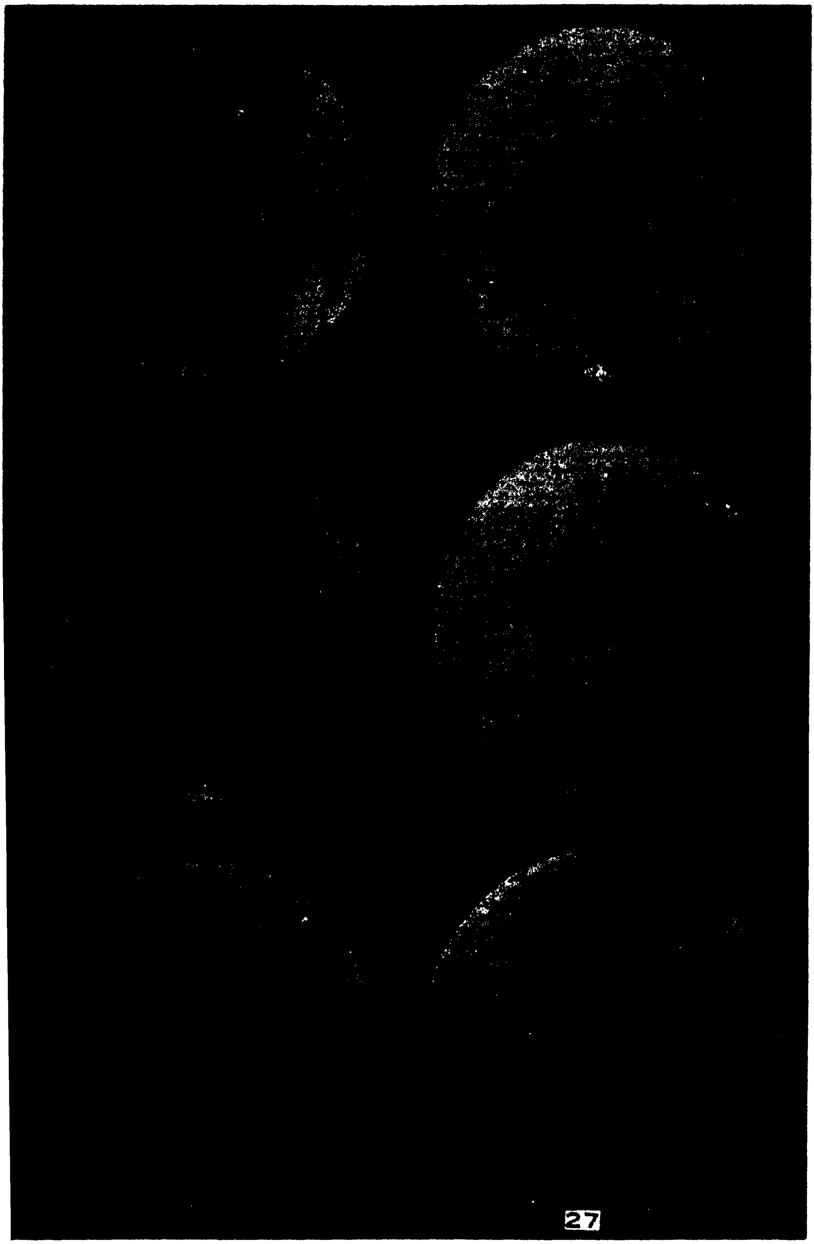
There is no trace of the segmental rods in either species, and from the appearance of the parts concerned in the deposition of the eggs it seems most probable that these are dropped indiscriminately, as in the Hepialidae.

The study of the genitalia of the Mnesarchaeidae throws little light on the relationships of the family. Meyrick (*Genera Insectorum,* fascicule 132, p. 3), from a consideration of other characters, assigns the group to an intermediate position between the Micropterygidae, and the Plutellidae and Tineidae, though not on the direct line of descent. The genitalia characters, however, bear hardly any

resemblance to either of these three families. Eyer (*Annals of the Entomological Society of America*, vol. 17, p. 306) considers that the Mnesarchaeidae, as far as the genitalia are concerned, lie between the Hepialidae on the one hand and the Micropterygidae, Eriocraniidae, and Aculeate Tineoidea on the other. With the relationship to the Hepialidae (and consequently to the Prototheoridae) the present writer agrees, but can see very little approach to any of the other groups referred to. Nor does he accept Dr. Eyer's interpretation of some of the parts; the extreme specialization of the structures makes it a difficult matter to homologise them with more normal examples.



For the photographic plate I desire to express my gratitude to Mr. Wm. C. Davies, of the Cawthron Institute, whose patience and skill are responsible for the excellent result.



Genitalia of *Mnesarchaea* species.

(From mounts in glycerine jelly, ventral views, harpes folded out.)

FIG. 22.—*M. similis* Philp. ♂. FIG. 23.—*M. hamadelpha* Meyr. ♂

FIG. 24.—*M. loxoscia* Meyr. ♂. FIG. 25.—*M. paracosma* Meyr. ♂.

FIG. 26.—*M. fusca* Philp. ♂. FIG. 27.—*M. fusca* Philp. ♀.

Face p. 714.

LIST OF FIGURES.

FIG. 1.—*Mnesarchaea hamadelpha* Meyr. ♀. Genitalia ventral view.
FIG. 2.—*M. hamadelpha* Meyr. ♀ Abdomen, lateral view.
FIG. 3.—*M. fusca* Philp. ♀. Genitalia, lateral view.
FIG. 4.—*M. similis* Philp. ♂. Vinculum and harpes, ventral view.
FIG. 5.—*M. hamadelpha* Meyr. ♂. Vinculum.
FIG. 6.—*M. hamadelpha* Meyr. ♂. Vinculum and harpes, ventral view.
FIG. 7.—*M. similis* Philp. ♂. Vinculum.
FIG. 8.—*M. paracosma* Meyr. ♂. Genitalia, dorsal view.
FIG. 9.—*M. paracosma* Meyr. ♂. Genitalia, ventral view.
FIG. 10.—*M. paracosma* Meyr. ♂. Genitalia, right lateral view.
FIG. 11.—*M. fusca* Philp. ♂. Vinculum.
FIG. 12.—*M. loxoscia* Meyr. ♂. Vinculum.
FIG. 13.—*M. paracosma* Meyr. ♂. Suspensorium, ventral view.
FIG. 14.—*M. paracosma* Meyr. ♂. Right half of tegumen.
FIG. 15.—*M. paracosma* Meyr. ♂. Left half of tegumen.
FIG. 16.—*M. fusca* Philp. ♂. Harpes.
FIG. 17.—*M. fusca* Philip. ♂. Genitalia, lateral view.
FIG. 18.—*M. paracosma* Meyr. ♂. Harpe, from within.
FIG. 19.—*M. fallax* Philp. ♂. Vinculum.
FIG. 20.—*M. fallax* Philp. ♂. Tegumen and suspensorium, ventral view under coverslip.
FIG. 21.—*M. fallax* Philp. ♂. Genitalia, lateral view.

LETTERING.

a, anus. at, anal tube. bc, bursa copulatrix. bs, basal part of suspensorium. cc, cucullus. db, ductus bursae. de, ductus ejaculatorius. dt, dorsal piece of tegumen. fbp, free basal piece of harpes. go, genital opening. h, harpe. lpt, left prong of tegumen. lt, lobes of tegumen. ps, prongs of suspensorium. rpt, right prong of tegumen. s, suspensorium. sc, sacculus. t, tegumen. u, uncus. v, vinculum. es, eighth sternite.

The Genitalia of the Genus *Gymnobathra* (Oecophoridae : Lepidoptera).

By Alfred Philpott,
Hon. Research Student in Lepidoptera, Cawthron Institute, Nelson.

[*Read before the Nelson Philosophical Society, 23rd November, 1925; received by Editor, 9th December, 1925; issued separately, 19th February, 1927.*]

The genus *Gymnobathra* was created by Meyrick in 1884, the type being *flavidella* Walker. Sixteen species have been described, of which a list is here given.

Gymnobathra philadelpha Meyr., *Trans. N.Z. Inst.*, vol. 16, p. 33.
Gymnobathra hyetodes Meyr., *ibid.*, vol. 16, p. 32.
Gymnobathra habropis Meyr., *ibid.*, vol. 20, p. 80.
Gymnobathra hamatella (Walk.), *Cat. Het.*, vol. 29, p. 700; Meyrick, *Trans. N.Z. Inst.*, vol. 16, p. 31.
Gymnobathra flavidella (Walk.), *Cat. Het.*, vol. 29, p. 665; Meyrick, *Trans. N.Z. Inst.*, vol. 16, p. 31.
Gymnobathra sarcoxantha Meyr., *Trans. N.Z. Inst.*, vol. 16, p. 29.
Gymnobathra coarctatella (Walk.), *Cat. Het.*, vol. 29, p. 768; Meyrick, *Trans. N.Z. Inst.*, vol. 16, p. 28.
Gymnobathra squamea Philp., *Trans. N.Z. Inst.*, vol. 47, p. 200.
Gymnobathra parca (Butl.), *Proc. Zool. Soc. Lond.*, 1887, p. 405; Meyrick, *Trans. N.Z. Inst.*, vol. 16, p. 29.
Gymnobathra calliploca Meyr., *Trans. N.Z. Inst.*, vol. 16, p. 30.
Gymnobathra bryaula Meyr., *Trans. Ent. Soc. Lond.*, 1905, 238.
Gymnobathra thetodes Meyr., *ibid.*, 1901, 574.
Gymnobathra cenchrias (Meyr.), *Trans. N.Z. Inst.*, vol. 41, p. 5.
Gymnobathra tholodella Meyr., *ibid.*, vol. 16, p. 30.
Gymnobathra omphalota Meyr., *ibid.*, vol. 20, p. 81.
Gymnobathra caliginosa n. sp. This volume.

Of the above sixteen species three, *philadelphia* Meyr., *thetodes* Meyr., and *sarcoxantha* Meyr., do not appear to have been recognised since their description in 1883. Two specimens of *sarcoxantha*, a male and a female, are in the Fereday collection at the Canterbury Museum, and through the courtesy of the Curator I have been able to examine these. They bear the date "1884" but have no locality label. The male I should certainly put down as belonging to the pale race of *G. coarctatella*. As far as can be ascertained from the dry specimen the genitalia do not differ from that species. The female has aborted hindwings, they being only about half as wide as the normal. Otherwise there is nothing to distinguish the specimen from *coarctatella*, and I have little hesitation in regarding it as merely an aberrant specimen of that species. *G. philadelpha* is represented in the same collection by four specimens, two of each sex, a label in Fereday's handwriting being pinned beside them. This label reads, "10/1/79, Mount Hut, bush gully north of Conical Hill." As the month and locality agree with those given for the type it is probable that these specimens represent part of the material taken at the same

time. But the specimens appear to me to belong to *G. habropis* Meyr.; there is no difference in the male genitalia.

In view of the number of figures which have been prepared it will not be necessary to deal with each species in detail; it will be sufficient to give a general description of the organs, pointing out marked specific differences.

GENERAL CHARACTERS OF THE MALE GENITALIA.

The Tegumen.—The tegumen in *Gymnobathra* is a well developed organ. Its lateral arms, which are rather narrow, are loosely attached to the apices of the vinculum and its dorsal apex is produced into a definite uncus. Viewed laterally the uncus does not seem to vary much, except in the matter of proportionate length, but a dorsal view reveals a very great diversity of shape. In *tholodella* it is short, narrow and spine-like; in *squamea* it is short and pointed but very broad basally; in *parca* and *flavidella* longer and finger-like; in *hamatella, hyetodes, habropis, omphalota, caliginosa* and *cenchrias* similar, but slightly spatulate; in *calliploca* deeply constricted basally and widely expanded apically. *G. bryaula* exhibits a very unusual uncus. It is sharply angled downwards at about half its length and its apex is expanded and truncated, forming an almost circular flat disc.

The Gnathos.—The gnathos is a chitinized band rising from both sides of the tegumen near the base of the uncus, and forming a half-hoop to support the anal tube. It may be directed downwards at right angles to the tegumen or obliquely backwards or forwards. In some species, as *squamea,* it is a simple half-hoop, in others, as *omphalota,* the sides are straightened and meet in a central point, this point being often produced into an upturned hook. *G. calliploca* has a most unusual gnathos. The arms do not approach each other, and the apex is formed by a straight broad cross-piece, the forward edge of which is clothed with short dense hair; the whole apparatus may be described as scoop-like.

The Vinculum.—The vinculum is small in *Gymnobathra,* reaching its greatest length in development in *omphalota, habropis, hyetodes,* and *hamatella.* The arms are thin, and frequently taper to a point; the basal plate may project forwards and backwards, or in one direction only.

The Aedeagus.—The aedeagus is usually short and stout, more or less curved, and with some spines within near the apex. In *tholodella* the organ is elongate and thin. Close to its apex and rectangularly projecting is a conical process, a feature not found in any of the other species.

The Juxta.—The juxta in this genus exhibits considerable variety of form. The most general feature is the presence of a pair of lobes, usually with some short hairs towards the apices. These lobes may be short and stout or thin and elongate; in several species there are a pair of chitinized plates between them, which, in more than one species curve round apically and almost encircle the aedeagus (see figures of *squamea* and *coarctatella*).

The Harpes.—The most general feature of the harpes in *Gymnobathra* is the development of the basal portion of the ventral margin into a separate lobe or process. In *calliploca* this is seen in its simplest form. A portion of the basal margin is folded in, and this fold has

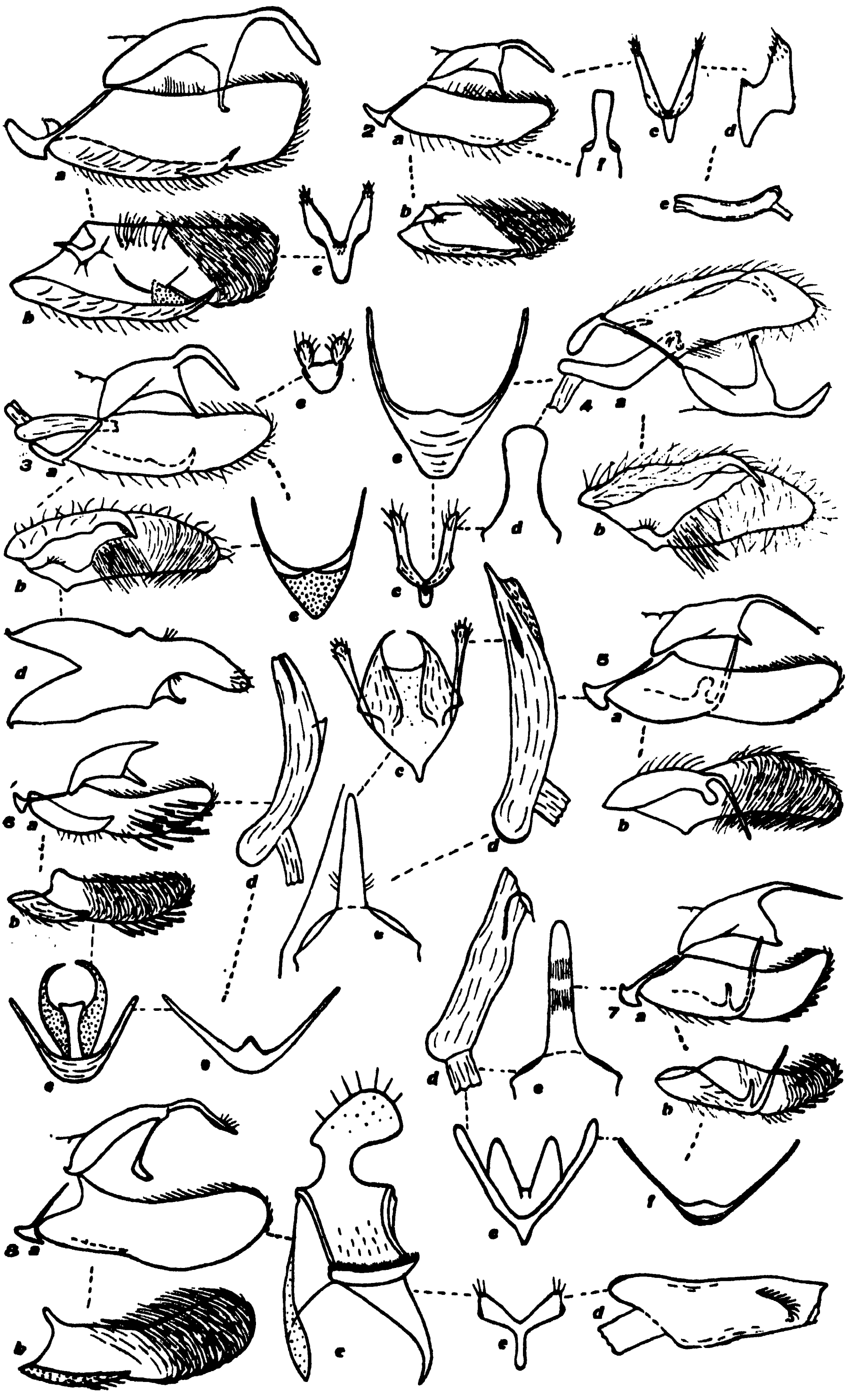
become a free cone for a short distance at its apex. The fold, with its free apex, can be seen gradually extending in length through other species while the apex tends to turn inwards. In *tholodella* the free apical portion reaches almost across the harpe, and a still further lengthening has occurred in *parca* and *coarctatella*. In the latter two species a small process has developed beneath the long one; in *parca* this is thin and pointed and in *coarctatella* it is broad and obtuse. In two species, *cenchrias* and *caliginosa,* the basal ventral portion of the harpe forms a separate lobe, being divided from the main portion by a deep fissure which reaches almost to the base of the organ. On the inner surface of the harpe there is usually a fairly dense clothing of fine long hair on the apical half directed obliquely backwards towards the dorsal margin, coarser hairs being generally found scattered about the other parts. *G. squamea* is peculiar in having the outer surface of the harpe clothed with elongate scales, and in *G. bryaula* a patch of similar scales occurs on the disc of the inner surface.

THE FEMALE GENITALIA.

In the normal position, all but the hairy apical half of the ninth segment is retracted within the eighth, the eighth being also partly telescoped within the seventh. When extended it is seen that the intersegmental membrane between the eighth and ninth segments is almost as long as the ninth segment, thus allowing of considerable elongation when the deposition of ova is taking place. The copulatory opening (ostium) is placed basad of the middle of the eighth segment. The ductus bursae is fairly strongly chitinized for a short distance from its commencement, the bladder-like bursa copulatrix being well differentiated from the duct.

KEY TO THE SPECIES OF *GYMNOBATHRA* BASED ON THE CHARACTERS OF THE MALE GENITALIA.

1.	Apex of dorsal lobe of harpes extending beyond costa	2.
	Apex of dorsal lobe of harpes not extending beyond costa	3.
2.	Second process of lobe narrow and pointed	*parca.*
	Second process of lobe broad and apically dilated......	*coarctatella.*
3.	Apex of dorsal lobe extending to costa of harpe	*tholodella.*
	Apex of dorsal lobe extending to costa of harpe	4.
4.	Apex of gnathos forming a disc	*bryaula.*
	Apex of gnathos not forming a disc	5.
5.	Gnathos more or less sickle-shaped on lateral view......	6.
	Gnathos not sickle-shaped on lateral view	8.
6.	Dorsal lobe of harpes flat, leaf-like	7.
	Dorsal lobe of harpes not leaf-like; folded, and apex directed across harpe	*omphalota.*
7.	Costal margin of harpes almost straight	*cenchrias.*
	Costal margin of harpes sinuate	*caliginosa.*
8.	Uncus deeply excised at base	*calliploca.*
	Uncus not deeply excised at base	9.
9.	Dorsal lobe of harpes short, tusk-like	*squamea.*
	Dorsal lobe of harpes not short	10.
10.	Uncus bent almost rectangularly	*flavidella.*
	Uncus not bent rectangularly	11.
11.	Uncus rounded at apex	*hamatella.*
	Uncus not rounded at apex	12.
12.	Uncus truncate at apex	*hyetodes.*
	Uncus emarginate at apex	*habropis.*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LIST OF FIGURES.

FIG. 1.—*Gymnobathra habropis* Meyr. *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta.

FIG. 2.—*Gymnobathra hyetodes* Meyr. *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta, ventral view; *d*, juxta, lateral view; *e*, aedeagus; *f*, uncus, dorsal view.

FIG. 3.—*Gymnobathra flavidella* (Walk.). *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, tegumen, obliquely dorsal view; *e*, vinculum.

FIG. 4.—*Gymnobathra hamatella* (Walk.). *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, uncus, dorsal view; *e*, vinculum.

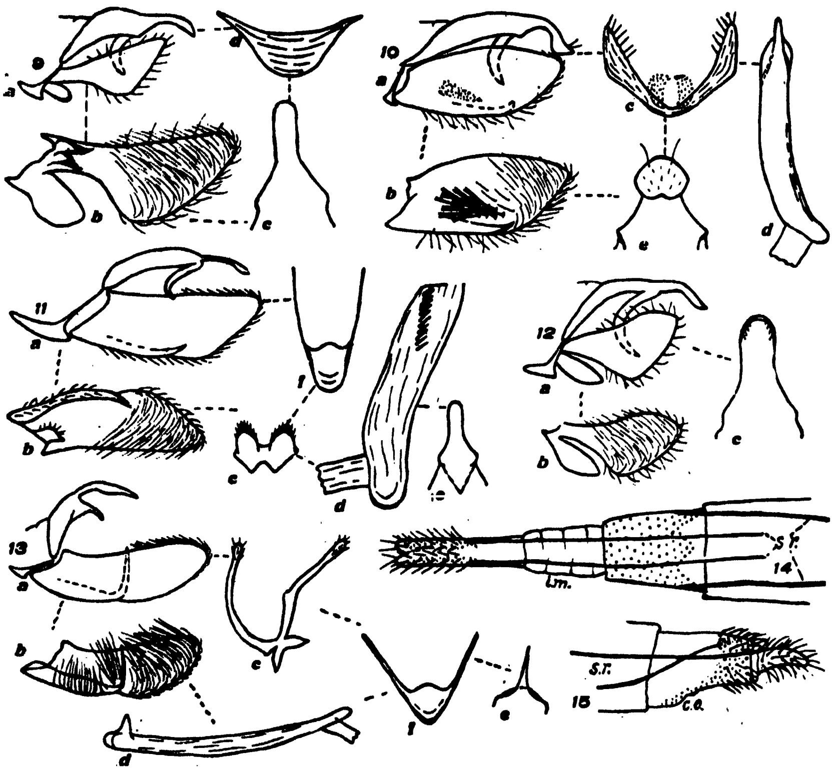


FIG. 5.—*Gymnobathra coarctatella* (Walk.). *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, aedeagus; *e*, uncus, dorsal view.

FIG. 6.—*Gymnobathra squamea* Philp. *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, aedeagus; *e*, vinculum.

FIG. 7.—*Gymnobathra parca* (Butl.). *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, aedeagus; *e*, uncus dorsal view; *f*, vinculum.

FIG. 8.—*Gymnobathra calliploca* Meyr. *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, aedeagus; *e*, tegumen, obliquely ventral view.

FIG. 9.—*Gymnobathra cenchrias* (Meyr.). *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, uncus, dorsal view; *d*, vinculum.

FIG. 10.—*Gymnobathra bryaula* Meyr. *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, aedeagus; *e*, uncus, ventral view.

FIG. 11.—*Gymnobathra omphalota* Meyr. *a*, male genitalia, lateral view; *b*, harpe, inner view; *c*, juxta; *d*, aedeagus; *e*, uncus, dorsal view; *f*, vinculum.
FIG. 12.—*Gymnobathra caliginosa* Philp. *a*, male genitalia, lateral view; *b*, harpes, inner view; *c*, uncus, dorsal view.
FIG. 13.—*Gymnobathra tholodella* Meyr. *a*, male genitalia, lateral view; *b*, harpes, inner view; *c*, juxta; *d*, aedeagus; *e*, uncus; *f*, vinculum.
FIG. 14.—*Gymnobathra coarctatella* (Walk.).. Female genitalia, dorsal view; *i.m.*, intersegmental membrane; *s.r.*, segmental rods.
FIG. 15.—*Gymnobathra flavidella* (Walk.). Female genitalia, lateral view; *s.r.*, segmental rods; *c.o.*, copulatory opening.

The Maxillae in the Lepidoptera.

By ALFRED PHILPOTT, Hon. Research Student in Lepidoptera, Cawthron Institute, Nelson, N.Z.

[*Read before the Nelson Philosophical Society, 2nd September, 1925; received by Editor, 10th September, 1925; issued separately, 22nd February, 1927.*]

The object of the present paper is to describe and figure the maxillae in all groups of which material has been available for study. Owing, however, to the limited nature of the lepidopterous fauna of New Zealand, the investigation must necessarily have proved very incomplete were it not that, through the kindness of correspondents, I have been able to study a fair number of forms from other regions. Though all the parts of the maxilla will be dealt with, the chief interest will centre in the maxillary palpi. In systematic works on the Lepidoptera, we frequently find it stated that in this or that group the maxillary palpi are absent. In many of these instances, however, careful examination will show that though the organs are extremely minute and vestigial, they are still to be found.

The general structure of the maxillae will now be briefly described, in order that the nomenclature applied to the various parts may be clearly understood. The first maxilla in the most generalized Lepidoptera consists of the following parts. (1) The Cardo, a more or less horizontally placed small basal piece, often somewhat triangular in shape. (2) The Stipes, a usually well developed sclerite following the cardo, generally longer than broad. (3) The Maxillary Palp, a four- or five-segmented appendage rising from the apical outward area of the stipes. (4) The Galea, a weakly chitinized irregularly cone-shaped structure springing from the central portion of the apex of the stipes; in all except the most primitive families the galeae are modified to form an elongated suctorial organ, the haustellum or tongue. (5) The Lacinia, a small pointed organ fused basally with the galea; in all but the Micropterygidae this organ is absent. Without dissection the cardo can seldom be seen; the stipes is usually at least partially visible; the galeae, when developed into the haustellum, become prominent, and can be seen in part even in the more primitive state; the palp, when reduced, is frequently completely hidden,

but when consisting of several segments it may come into view by hanging downwards clear of the other mouth-parts or by being curved upwards till it rests above the labial palp; the lacinia is always hidden. Certain parts which are present in some of the other orders of insects are not definitely recognizable in the Lepidoptera. These are the subgalea, a sclerite lying on the inner side of the stipes, and the digitus, or finger, a small structure forming a second segment to the lacinia. There is also the palpifer, a pedestal on which the maxillary palp articulates, but in the Lepidoptera this structure, when present, appears as an outgrowth of the stipes; it is, however, at times so prominent that it might easily be mistaken for the basal segment of the palp. Figures giving front and back views (or from above and beneath) of the head of *Sabatinca incongruella* (Walk.) are shown, in order to display the mouth parts as they appear *in situ*. These figures, in common with all the others, have been drawn with the aid of a camera lucida from material macerated in a ten per cent. solution of KOH.

A detailed description of the maxilla, from its primitive condition in the most generalised types to its specialised forms in the higher families, will now follow.

LEPIDOPTERA HOMONEURA.

Micropterygidae (Figs. 1 to 4).

The Micropterygidae is the only family of Lepidoptera in which the five main parts of the maxillae are present. In all the others at least one part, the lacinia, is missing. I have been able to examine all the genera belonging to this family. There is little difference between the groups, but it will be seen from figures 2, 3 and 4 that the cardo in *Epimartyria* is broader and more triangular than in *Sabatinca*, while in *Micropteryx* it is irregularly oblong. The lacinia in *Sabatinca* is of a more primitive type than in the other two genera, being acutely pointed and closely appressed to the galea. The galea consists of one segment only, but indentations and one or two half bands of stronger

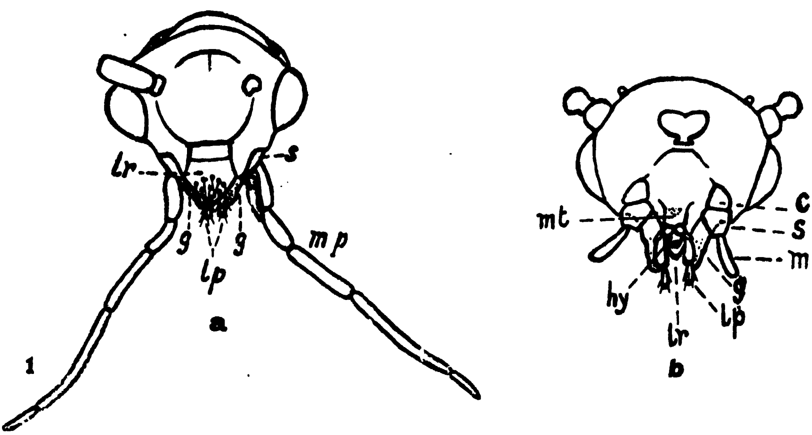


Fig. 1.—*Sabatinca incongruella* Walk. Head; a, dorsal view; b, ventral view.

chitinisation near the middle of the organ possibly point to a former articulation. On both lacinia and galea are some short fine sensory hairs. The palp consists of five segments; the first two are of about the same length, the third a little longer than the second, the fourth about as long as the second and third together, and the fifth very short, about half the length of the first. In *Micropteryx* and *Sabatinca* the fourth segment is covered, except near the base, with fine annulations, but these do not appear to be present in *Epimartyria.* The proportionate length of the whole organ as compared with the labial palps and head can be seen by reference to fig. 1.

Species examined: *Sabatinca incongruella* Walk.; *S. chrysargyra* Meyr., *S. aurella* Huds., *S. ianthina* Philp., *Micropteryx aruncella* Scop., *M. calthella* L., *Epimartyria auricrinella* Wlshm., *E. pardella* Wlshm.

ERIOCRANIIDAE (Figs. 5 to 6).

In this family the maxillae have undergone great specialization, the laciniae having completely disappeared and the galeae having been transformed into an haustellum, a change correlated with the loss of the mandibles. The haustellum, though not elongate, is fully functional, and differs in no essential way from that of the Lepidoptera Heteroneura. The remainder of the maxilla shows but slight change from the same part in the Micropterygidae; the second segment of the palp, however, is here rather shorter than the first. The genera *Neopseustis*, represented by one species from India, and *Acanthopteroctetes*, known only from a single North American specimen, have not been available for study.

Species examined: *Mnemonica auricyanea* Wlshm., *Eriocrania semipurpurella* Steph.

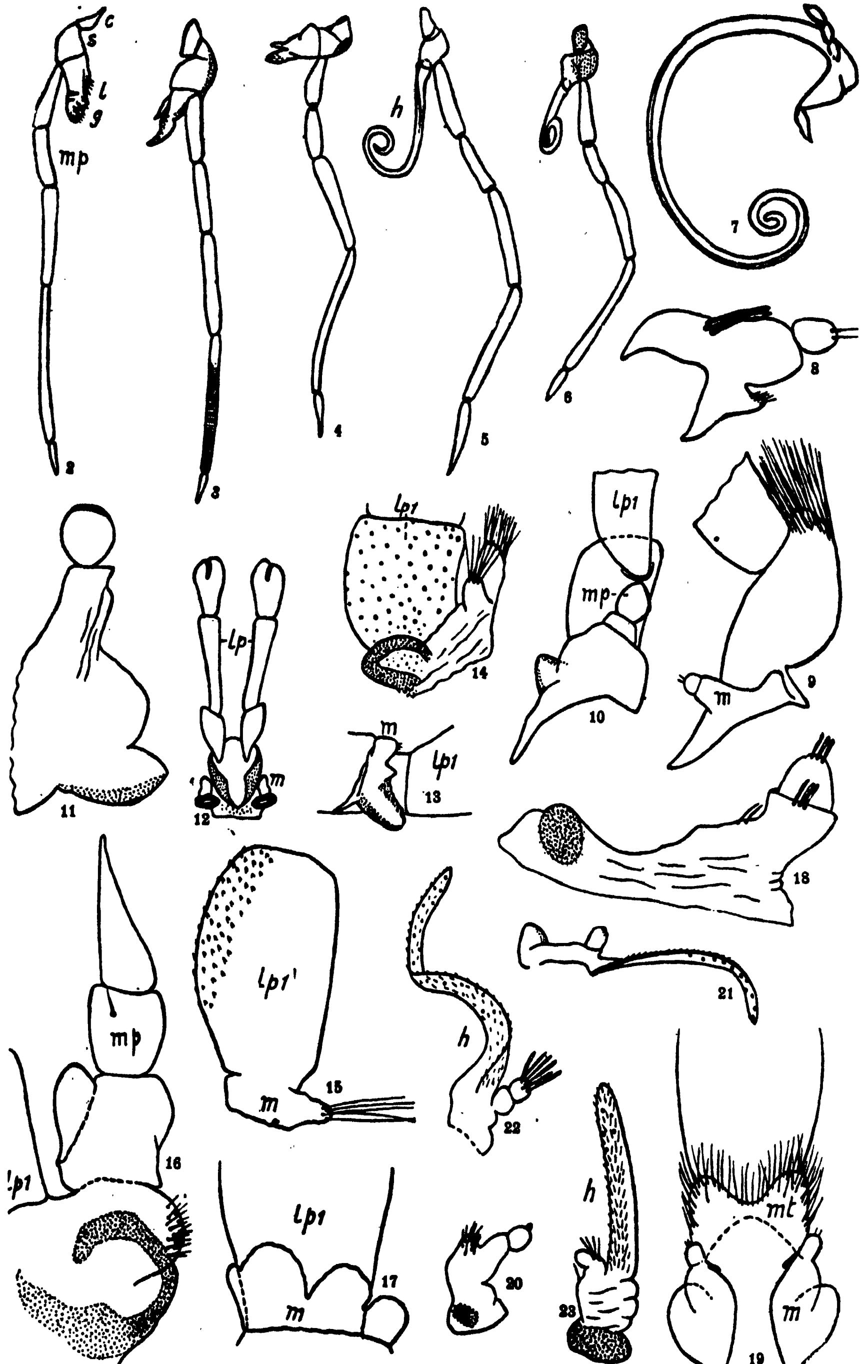
MNESARCHAEIDAE (Fig. 7).

The Mnesarchaeidae, which includes the type genus only, is an extremely specialized family of the Micropterygoidea. Meyrick (*Genera Insectorum*, fasc. 132, p. 3) places the group as intermediate between the typical Micropterygidae and the Tineidae, though not on the actual line of transition. The maxillae share in the general specialization, the haustellum being lengthened and the palp reduced to three more or less globular segments the whole of which do not exceed in length the basal segment of the palp in the Micropterygidae. Meyrick (*ibid.*) instances the absence of vein 1b (R1) as being proof of the family not being ancestral to the Tineidae and to this character may be added the vestigial condition of the maxillary palp, many of the Tineidae having well-developed palpi of four or five segments.

Species examined: *Mnesarchaea hamadelpha* Meyr., *M. loxoscia* Meyr., *M. fusca* Philp.

HEPIALIDAE (Figs. 8 to 23).

The Hepialidae are a very isolated family, and the study of the maxillae gives little help towards discovering its relationships. Though excessively reduced in most cases, I have not examined any genus in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Figs. 2-23.

which some trace of the maxillae could not be found. Generally what remains of the organ takes the shape of a cluster of bulbous protuberances at the base of the labium and curving transversely round it. The basal or lower piece is usually more strongly chitinized laterally, which gives it the appearance of a link-shaped structure when viewed from above. As there is no articulation or defined divisions between the parts it is not possible to homologize them with certainty with the parts composing the normal maxillae, more especially as the position of the structure has been so altered. In systematic works on the Lepidoptera it is usually stated that the maxillary palpi are absent in the Hepialidae. This, however, is by no means always, or even generally, the case. Reference to the figures will show that in *Trictena, Perrissectis,* and *Sthenopis (argenteomaculatus)* there is a distinct one-segmented palp present, though the rest of the organ is extremely reduced. In *Porina dinodes* a similar palp occurs, apparently resting on a distinct palpifer; in other species of this genus, as *P. jocosa,* the palp appears to be absent. *Hepialus humuli* also shows a palpal segment, though less defined than that of *P. dinodes.* In passing, it may be noted that the labial palps in this species have practically disappeared, being represented only by a pair of rounded palpigers. *Oncopera mitocera* has the most vestigial maxillae of any of the Hepialidae. They amount merely to minute protuberances bearing a few rather long hairs. As the eyes in this genus nearly meet in the middle line of the face there is little room left for upturned mouth-parts and the labium is consequently greatly compressed, while the labial palpi tend to become thread-like. The gigantic Australian *Leto staceyi* possesses the least reduced maxillary palpi of any species of the family examined. There are here two well-developed segments, the basal one articulating with what is probably a palpifer as the much reduced galea fuses with it basally. The terminal segment of the palp is longer than the preceding one and tapers to a fine point. The whole structure lies less transversely to the labium than usual,

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FIG. 2.—*Sabatinca aurella* Huds. Maxilla.
FIG. 3.—*Micropteryx calthella* L. Maxilla.
FIG. 4.—*Epimartyria auricrinella* Wlshm. Maxilla.
FIG. 5.—*Mnemonica auricyanea* Wlshm. Maxilla.
FIG. 6.—*Eriocrania semipurpurella* Steph. Maxilla.
FIG. 7.—*Mnesarchaea loxoscia* Meyr. Maxilla.
FIG. 8.—*Trictena labyrinthica* Don. Maxilla.
FIG. 9.—*Perrissectis australasiae* Don. Maxilla and labium.
FIG. 10.—*Sthenopis argenteomaculatus* Harr. Maxilla and labium.
FIG. 11.—*Porina dinodes* Meyr. Maxilla.
FIG. 12.—*P. jocosa* Meyr. Maxilla, labium and labial palpi.
FIG. 13.—*P. jocosa* Meyr. Maxilla and labium.
FIG. 14.—*P. signata* Walk. Maxilla and labial palp.
FIG. 15.—*Oncoptera mitocera* Turn. Maxilla and labial palp.
FIG. 16.—*Leto staceyi* Scott. Maxilla.
FIG. 17.—*Charagia virescens* Dbld. Maxilla.
FIG. 18.—*Pielus hyalinatus* H.S. Maxilla.
FIG. 19.—*Hepialus humuli* L. Maxilla and labium.
FIG. 20.—*Hectomanes sp.* Maxilla.
FIG. 21.—*H. simulans* Walk. Maxilla.
FIG. 22.—*H. bilineata* Meyr. Haustellum and maxillary palp.
FIG. 23.—*H. sp.* Maxilla.

the palp projecting obliquely above that organ. The Maxillae in *Hectomanes* show some extremely interesting features. Seven species have been available for examination. Four of these, *H. fusca, H. polyspila, H. crocea,* and an undetermined species, have a rounded one-segmented palp with a very minute tubercle arising from its apex; this may be the vestige of a second segment. The galea is represented by a rounded projection bearing some rather strong spines. In *H. simulans, H. bilineata,* and a second undetermined species, however, the galea is present as a true haustellum, though one which has been subject to great reduction. The labial palp in these species, as in the other three, consists of only two short segments, the haustellum, when present, being of about the same length as the palpi. In the second undetermined species the haustellum is rather broad, finger-like, and clothed with short hairs; in *H. simulans* and *H. bilineata* it is narrower, rather longer than the labial palpi and has more the appearance of a normal functional haustellum.

Species examined: *Oncopera mitocera* Turn., *Perrissectis australasiae* Don., *Sthenopis argenteomaculatus* Harr., *Pielus hyalinatus* H.S., *Trictena labyrinthica* Don., *Porina jocosa* Meyr., *P. dinodes* Meyr., *P. signata* Walk., *P. fuscomaculata* Walk., *Charagia virescens* Dbld., *Hepialus humuli* L., *H. gracilis* Grt., *Leto staceyi* Scott, *Hectomanes crocea* Luc., *H. fusca* Luc., *H. polyspila* Meyr., *H. simulans* Walk., *H. bilineata* Meyr., *H. spp.* (2).

Prototheoridae (Figs. 24 and 25).

In this family there is a short, two-segmented maxillary palp and an haustellum which reaches nearly to the middle of the labial palpi. The haustellum is of normal thickness and is covered with short hair, the apex being blunt. The cardo and stipes are of the Hepialoid type.

Species examined: *Prototheora petrosema* Meyr., *Metatheora corvifera* Meyr.

LEPIDOPTERA HETERONEURA.

Nepticulidae (Figs. 26 and 27).

In *Nepticula* the maxillary palp is 5-segmented and the galea, which is flattened on the inner side and armed on its lower margin with a row of curved spines, is very short. Having regard to the primitive nature of certain characters of this genus,—for instance, the retention of a small fibula and series of costal spines in some of the more generalised species,—it seems possible that the haustellum is here rather rudimentary than vestigial.

Species examined: *Nepticula rhamnicola* Braun, *N. lucida* Philp.

Incurvariidae (Fig. 28).

Only one species of this family (Meyrick places the type genus in the Tineidae and gives the maxillary palpi as "long, filiform, folded") has been examined. This was *Chalceopla cyanella* Busck. The maxillary palp consists of two short, more or less globular segments. The haustellum is long and the cardo and stipes are normal.

PRODOXIDAE (Figs. 29 to 31).

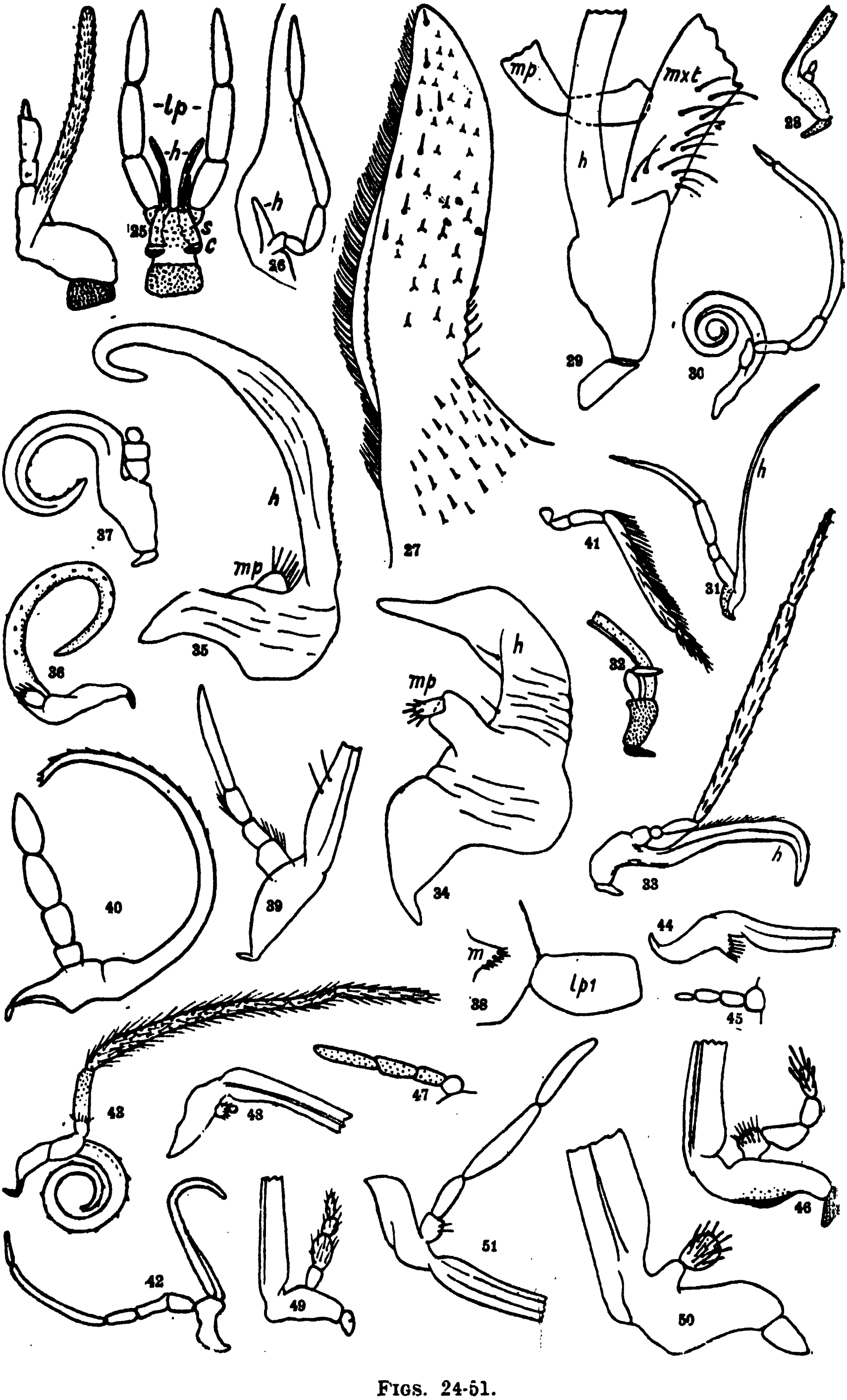
In this family, which consists of the genera *Tegiticula* and *Prodoxus* only, the maxiliary palpi are 5-segmented and ordinarily folded as in many of the Tineidae. In the very long fourth segment followed by the short apical one there is some resemblance to the Micropterygid type but the same structure also obtains in the generalised Tineoids. A well-developed haustellum is present in both genera and in the female of *Tegiticula* a unique organ, known as the maxillary tentacle, is present. This structure rises from the apex of the stipes, and is quite twice as thick and a little longer than the galea (haustellum). It is covered, except dorsally, with stout spines, set in a ring-like base. It takes a downward course, curving round in a half-circle, the maxillary palpi springing from near its base. Riley (*Third Annual Report, St. Louis, Mo.*, 1892, p. 99) has fully described the function of this curious organ, its use being to hold the ball of pollen which the moth gathers from the yucca plant as provender for its future larvae. Riley regarded the tentacle as the greatly-modified basal segment of the maxillary palp, but other investigators have considered it to be an extension of the palpifer. The writer inclines to Riley's view. If the maxilla of the male is examined it will be seen that the basal segment of the maxillary palp has an apical process pointing in the direction which, in the female, is followed by the maxillary tentacle. It will also be noticed that in the female, though the base of the tentacle is not freely articulated with the stipes, there is an indication, in the form of a dorsal fold, of a former jointing. As the function of the tentacle is to hold the ball of pollen, it would be an advantage for the basal joint to become more or less fused so that it would grip the mass by an automatic spring action, there being, as far as is known, no provision for muscular control. Another point which may have some bearing on the matter may be mentioned. Reference has been made to the strong spines which are present on the maxillary tentacle, but not on the maxillary palp, and if the labial palpi be examined it will be found that the basal segment is armed with exactly similar spines, which are absent from the following segments. In *Prodoxus* the maxillae are alike in both sexes, the female showing no trace of a maxillary tentacle.

Species examined: *Tegiticula alba* Z., *Prodoxus quinquepunctella* Chamb.

ADELIDAE (Fig. 32).

Meyrick (*Genera Insectorum*, fasc. 133, p. 1) describes the maxillary palpi of this family as "5-jointed, or 3-jointed, or rudimentary, porrected or folded." In *Adela bella* Chamb., the only species available for examination, the maxillary palpi is 2-segmented and the haustellum long and coiled. The first segment of the palp is in line with the haustellum, but the second takes an upward course at a right angle. The cardo and stipes are strongly chitinised.

Species examined: *Adela bella* Chamb.



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FIGS. 24-51.

OPOSTEGIDAE (Fig. 33).

The maxillae of this group are of a fairly primitive type, the maxillary palpi being 5-segmented with a very long fourth segment, and the haustellum short and stout.

Species examined: *Opostega 4-strigella* Chamb., *Opostega nonstrigella* Chamb.

COSSIDAE (Figs. 34 and 35).

Though many lepidopterists now regard the Cossids as the most primitive of the Heteroneura, the maxillae have undergone extreme reduction. In *Zeuzera pyrina* L. the haustellum is represented by a very short flaccid vestige and the maxillary palp consists of a small basal segment and a minute apical one, the latter bearing a few hairs. The cardo and stipes are not differentiated and the whole organ is weakly chitinized. The labial palpi are also reduced to two segments. In *Xyleutes eucalypti* H. S., the haustellum is short and thread-like while the palp consists of but one minute papilla. In *Xyleutes* no maxillae were found.

Species examined: *Xyleutes eucalypti* H.S., *Zeuzera pyrina* L.

MEGALOPYGIDAE.

LACOSOMIDAE.

In these two small families only one species of each was examined. The maxillae were absent and the labial palpi reduced to two small segments.

Species examined: *Lagoa crispata* Pack. (Megalopygidae), *Cicinus melsheimeri* Harr. (Lacosomidae.)

FIG. 24.—*Metatheora corvifera* Meyr. Maxilla.
FIG. 25.—*M. corvifera* Meyr. Maxilla, labium and labial palpi.
FIG. 26.—*Nepticula lucida* Philp. Maxilla.
FIG. 27.—*N. lucida* Philp, Haustellum (or galea).
FIG. 28.—*Chalceopla cyanella* Busck. Maxilla.
FIG. 29.—*Tegiticula alba* Z. Female, maxilla.
FIG. 30.—*T. alba* Z. Male, maxilla.
FIG. 31.—*Prodoxus quinquepunctella* Chamb. Maxilla.
FIG. 32.—*Adela bella* Chamb. Maxilla.
FIG. 33.—*Opostega 4-strigella* Chamb. Maxilla.
FIG. 34.—*Zeuzera pyrina* L. Maxilla.
FIG. 35.—*Z.* sp.
FIG. 36.—*Lithacodes fasciola* H.S. Maxilla.
FIG. 37.—*Cochlidion biguttata* Pack. Maxilla.
FIG. 38.—*Mallobathra strigulata* Philp. Maxilla and portion of labium.
FIG. 39.—*Archyala terranea* Butl. Maxilla.
FIG. 40.—*Scardia australasiella* Don. Maxilla.
FIG. 41.—*Sagephora phortegella* Meyr. Maxillary palp.
FIG. 42.—*Lindera tessellatella* Blanch. Maxilla.
FIG. 43.—*Hieroxestis omoscopa* Meyr. Maxilla.
FIG. 44.—*Bedellia somnulentella* Z. Maxilla.
FIG. 45.—*Protosynaema eratopis* Meyr. Maxillary palp.
FIG. 46.—*Plutella maculipennis* Curt. Maxilla.
FIG. 47.—*Orthenches similis* Philp. Maxillary palp.
FIG. 48.—*Zelleria copidota* Meyr. Maxilla.
FIG. 49.—*Tonza purella* Walk. Maxilla.
FIG. 50.—*Lactura egrigiella* Walk. Maxilla.
FIG. 51.—*Gracilaria linearis* Butl. Maxilla.

EUCLEIDAE (LIMACODIDAE) (Figs. 36 and 37).

Nine genera of the Eucleidae have been examined, six of which, i.e. *Doratifera, Susica, Euclea, Adoneta, Monoleuca,* and *Limacodes,* have entirely lost the maxillae. In the remaining three, *Prolimacodes, Lithacodes,* and *Cochlidion,* minute maxillae are present, consisting of cardo, stipes, haustellum, and maxillary palpi. The haustellum may possibly still be of use as it bears a series of papillae on its lower surface. *Cochlidion* has maxillary palpi of three small, somewhat globular segments; in *Lithacodes* and *Prolimacodes* the organ is reduced to a single tiny segment. It may be noted that in this family the labial palpi, though short, are usually three-segmented; in *Cochlidion,* however, only two segments are present.

Species examined: *Doratifera vulnerans* Lew., *D. oxlei* Newm., *Susica humeralis* Walk., *Euclea paenulata* Clem., *Adoneta spinuloides* H.S., *Monoleuca semifascia* Walk., *Prolimacodes scapha* Harr., *Lithacodes fasciola* H.S., *Cochlidion biguttata* Pack.

TINEIDAE (Figs. 38 to 41).

The Tineidae exhibit a very great diversity in the condition of the maxillae. In many genera all the parts except the lacinia, i.e. the cardo, stipes, haustellum, and maxillary palpi, are present. The palps do not differ much from those of the Micropterygidae, being 5-segmented, folded, and with the fourth segment as long or longer than the three preceding ones. The haustellum is short, but often stout and well formed, giving the impression of a developing structure rather than one undergoing reduction. To this group with the 5-segmented palpi belong the genera *Lysiphragma, Opogona, Tinea, Monopis, Prothinodes, Lindera,* and *Sagephora.* Of *Scardia* three species have been dissected, with unexpected results. *S. clonodes* Meyr. has maxillary palpi of the type just referred to, but in *S. australasiella* Don. and *S. primaeva* Meyr. the palps are 4-segmented and more or less moniliform. This genus, however, seems to be an ill-defined one; none of the three species referred to agrees in venation with either of the others. *Archyala* also had a 4-segmented unfolded palp, but in this instance the terminal segment is about as long as the first three. In *Mallobathra* there is only a minute vestige of the maxilla left. This takes the form of a papilla bearing a number of short but stout spines set on a circular base; it is probably the remains of the basal segment of the palp. *Narycia* represents the final stage in the reduction of the maxillae, the organ having here completely disappeared.

Species examined: *Lysiphragma epixyla* Meyr., *Lindera tessellatella* Blanch., *Monopis ethelella* Newm., *Tinea accusatrix.,* Meyr., *T. fagicola* Meyr., *Prothinodes grammocosma* Meyr., *Sagephora phortegella* Meyr., *Opogona micranthes* Meyr., *Scardia primaeva* Meyr., *S. clonodes* Meyr., *S. australasiella* Don. *Archyala terranea* Butl., *Taleporia cawthronella* Philp., *Mallobathra strigulata* Philp., *Narycia saxosa* Meyr.

LYONETIIDAE (Figs. 43 and 44).

Most of the genera in this family differ little, as regards the maxillae, from the generalized Tineidae. The haustellum is short, but not

extremely so, and in most cases probably functional. The palpi are five-segmented and the fourth segment is very long; the third segment, however, tends to be of greater length than in the Tineids. *Hieroxestis, Hectacma, Erechthias,* and *Eschatotypa* exhibit this type, but *Bedellia* possesses quite a different structure. Here the haustellum is long and the palp reduced to a minute tubercle bearing an armature of a few short hairs.

Species examined: *Hieroxestis omoscopa* Meyr., *Hectacma stilbella* *Dbld., Erechthias externella* Walk., *Eschatotypa derogatella* Walk., *Bedellia somnulentella* Z.

PLUTELLIDAE (Figs. 45 to 47).

Here the haustellum is well developed and the maxilliary palpi consist of four more or less filiform segments. There is usually a folding at the base, recalling the structure of the generalized Tineids. The cardo is large and well chitinized.

Species examined: *Plutella maculipennis* Curt., *Orthenches similis* Philp., *Dolichernis chloroleuca* Meyr., *Protosynaemis eratopis* Meyr.

HYPONOMEUTIDAE (Figs. 48 to 50).

In all the genera of this family examined, with the exception of *Tonza*, a minute two-segmented maxillary palp was found; in *Tonza* the palp has four segments. The haustellum is long and well developed and the other parts are normal.

Species examined: *Tonza purella* Walk., *Lactura egregiella* Walk., *Hyponomeuta interellus* Walk., *Zelleria copidota* Meyr.

GRACILARIIDAE (Figs. 51 to 53).

The Gracilariidae are characterized by a very long haustellum and a four-segmented maxillary palp. The palp is not porrect and the basal segment is more or less globular. In some genera, as *Epicephala* and *Parectopa,* the terminal segment is the longest of the four but in others, as *Acrocercops* and *Gracilaria,* the third has the greatest length. A full-length figure of the haustellum of *Epicephala* is given. It is here about five times the length of the maxillary palp but in *Gracilaria* it is about eight times as long.

Species examined: *Gracilaria linearis* Butl., *G. selenitis* Meyr., *G. xylophanes* Turn., *Acrocercops ordinatella* Meyr., *A. calicella* Stt., *Parectopa formosa* Stt., *Epicephala frugicola* Turn.

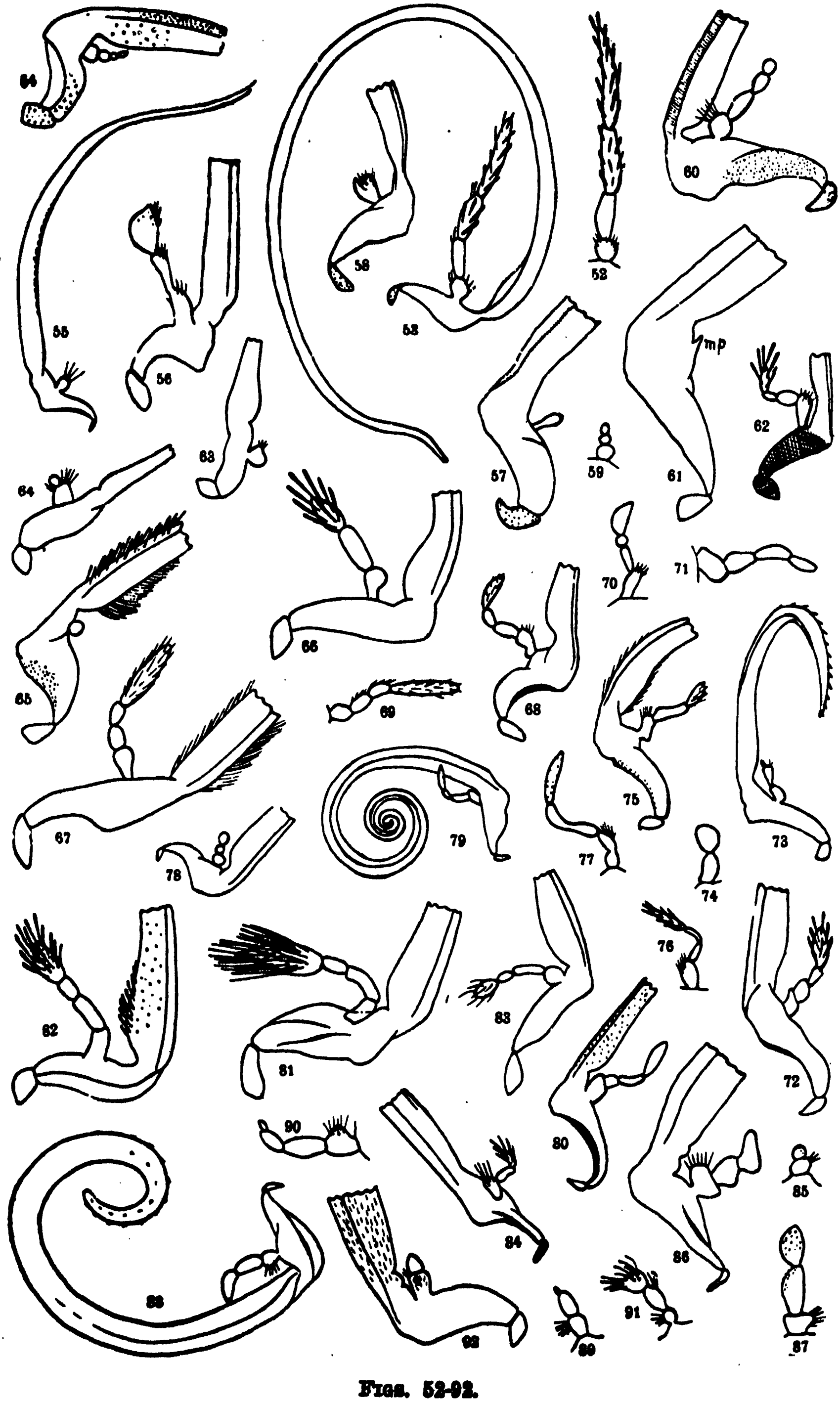
SCYTHRIDAE (Fig. 54).

A single species of this family has been examined. The haustellum was found to be well developed, the stipes normal, and the cardo large and subquadrate. The maxillary palp consisted of four globular segments, the series diminishing in size to the apex.

Species examined: *Scythris epistrota* Meyr.

ELACHISTIDAE (Fig. 55).

In the type genus, the only one examined, the haustellum is much reduced, and an extremely minute maxillary palp is present. The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FIGS. 52-92.

segments are globular, and in *Elachista thallophora* Meyr. there are two of these, but in *E. archaeonoma* Meyr. and *E. exaula* Meyr. only one remains.

Species examined: *Elachista thallophora* Meyr., *E. archaeonoma* Meyr., *E. exaula* Meyr.

COLEOPHORIDAE (Fig. 56).

Batrachedra is the only genus of this family which has been available for examination. In this instance I have found some difficulty in making out the number of segments in the maxillary palpi. It seems probable, however, that there are three, the first two being more or less fused. The terminal one is swollen and lemon-shaped. As in the preceding family, the haustellum is long and well developed.

Species examined: *Batrachedra agaura* Meyr.

GLYPHIPTERYGIDAE (Figs. 57 to 62).

In the Glyphipterygidae the genera *Hierodoris* and *Heliostibes* have a four-segmented maxillary palp. The segments are short, and

FIG. 52.—*Parectopa formosa* Stt. Maxillary palp.
FIG. 53.—*Epicephala frugicola* Turn. Maxilla.
FIG. 54.—*Scythris epistrota* Meyr. Maxilla.
FIG. 55.—*Elachista archaeonoma* Meyr. Maxilla.
FIG. 56.—*Batrachedra agaura* Meyr. Maxilla.
FIG. 57.—*Choreutis bjerkandrella* Thunb. Maxilla.
FIG. 58.—*Simaethis albifasciata* Philp. Maxilla.
FIG. 59.—*Glyphipteryx transversella* Walk. Maxillary palp.
FIG. 60.—*G. cometophora* Meyr. Maxilla.
FIG. 61.—*Imma acosma* Turn. Maxilla.
FIG. 62.—*Heliostibes electrica* Meyr. Maxilla.
FIG. 63.—*Amphithera heteroleuca* Turn. Maxilla.
FIG. 64.—*Encoptila idiopis* Turn. Maxilla.
FIG. 65.—*Eretmocera flavicincta* Turn. Maxilla.
FIG. 66.—*Vanicela xenadelpha* Meyr. Maxilla.
FIG. 67.—*Stathmopoda melanochroa* Meyr. Maxilla.
FIG. 68.—*Machimia zatrephes* Turn. Maxilla.
FIG. 69.—*Eulechria baryptera* Turn. Maxillary palp.
FIG. 70.—*Macrobathra diplochrysa* Low. Maxillary palp.
FIG. 71.—*Nymphostola galactina* Feld. Maxillary palp.
FIG. 72.—*Eschatura lemurias* Meyr. Maxilla.
FIG. 73.—*Cryptophaga rubescens* Lew. Maxilla.
FIG. 74.—*C. nubila* Luc. Maxillary palp.
FIG. 75.—*Xylorycta melaleucae* Turn. Maxilla.
FIG. 76.—*Telecrates laetiorella* Walk. Maxillary palp.
FIG. 77.—*Neodrepta luteotactella* Walk.
FIG. 78.—*Apatetris melanombra* Meyr. Maxilla.
FIG. 79.—*Phthorimaea operculella* Z. Maxilla.
FIG. 80.—*Trachydora droserodes* Meyr. Maxilla.
FIG. 81.—*Glaphyristis marmarea* Meyr. Maxilla
FIG. 82.—*Pyroderces deliciosella* Walk. Maxilla.
FIG. 83.—*Cosmopteryx mimetis* Meyr. Maxilla.
FIG. 84.—*Irenicodes eurychora* Meyr. Maxilla.
FIG. 85.—*Bactra noteraula* Walshm. Maxillary palp.
FIG. 86.—*Eucosma trangulana* Meyr. Maxilla.
FIG. 87.—*Spilonota macropetana* Meyr. Maxillary palp.
FIG. 88.—*Acropolitis rudis* Walk. Maxilla.
FIG. 89.—*Tortrix postvittana* Walk. Maxillary palp.
FIG. 90.—*T. amoenana* Meyr. Maxillary palp.
FIG. 91.—*Cacoecia polygraphana* Walk. Maxillary palp.
FIG. 92.—*Proselena antiquana* Walk. Maxilla.

the organ is folded like that of the Plutellids. In *Glyphipteryx* the palp may be either three- or four-segmented, the structure being much smaller than in the preceding genera. In *Simaethis* the palp consists of one segment only, but its peculiar shape may indicate that the second segment has been much reduced and has become fused with the basal one. *Choreutis* exhibits a single segment, and in *Imma* the palp is represented by a mere papilla. The cardo and stipes are usually large and well chitinised but the haustellum is rather weak. It was noticeable that in this family many specimens had either lost the maxillae entirely or had the haustellum broken off short near the base.

Species examined: *Heliostibes electrica* Meyr., *Hierodoris frigida* Philp.,*Glyphipteryx cometophora* Meyr., *G. chrysoplanetis* Meyr., *G. zelota* Meyr., *G. octonaria* Philp., *G. ataracta* Meyr., *G. transversella* Walk., *G. achlyoessa* Meyr., *G. acronoma* Meyr., *Simaethis albifasciata* Philp., *S. combinatana* Walk., *S. analoga* Meyr., *Choreutis bjerkandrella* Thunb., *Imma acosma* Turn.

HELIODINIDAE (Figs. 65 to 67).

Of the genera examined in this family *Stathmopoda* has the least reduced maxillary palpi, the organ consisting of four segments, the apical one of which is comparatively long. *Vanicela* has lost another segment, but the second is rather elongate and possibly represents the fused second and third. *Thylacosceles* possesses only two greatly reduced segments, and in *Eretmocera* there is but a single small globular segment. The cardo and stipes are well developed and the haustellum, though of less than normal length, is apparently functional.

Species examined: *Stathmopoda melanochroa* Meyr., *S. crocophanes* Meyr., *S. coracodes* Meyr., *Vanicela disjunctella* Meyr., *V. xenadelpha* Meyr., *Thylacosceles acridomima* Meyr., *Eretmocera flavicincta* Turn.

AMPHITHERIDAE (Figs. 63 and 64).

Only two species of the Amphitheridae have been examined. The haustellum was found to be of normal structure, and the maxillary palp consisted, in one instance, of two segments—a rather stout basal one and a minute globular apical one—and in the other of a single segment

Species examined: *Enchoptila idiopis* Turn., *Amphithera heteroleuca* Turn.

OECOPHORIDAE (Figs. 68 to 71).

In this extensive family there seems to be a remarkable uniformity in the structure of the maxillae. The cardo, stipes, and haustellum are usually normal, though the latter is in some instances rather short and evidently somewhat reduced. The maxillary palpi are always four-segmented and are only generically differentiated, and that in only a few instances, by the shape and size of the segments. The basal segment is generally irregular, the posterior side having frequently a deep construction and the anterior side being swollen and bearing a group of stiff hairs. The second and third segments are rather shorter and the apical one may be from very slightly longer,

as in *Borkhausenia,* to as long as the first three segments, as in *Eulechria.* In a few genera, as *Macrobathra* and others, the apical segment is swollen, making a clavate palp. In the normal position the palp is bent round and closely embraces the base of the haustellum, the apical segment lying against its upper surface. The genus *Nymphostola* is the only one which tends to stand by itself in the matter of palpal structure. Here there are the usual four segments, but they are very closely set, and the divisions not at all clearly indicated, so that the organ has the appearance of a finger-like process rather than a segmented structure.

The foregoing observations must not, however, be taken as conclusive, only forty-two out of the total of more than three hundred genera which constitute the family having been available for examination.

Species examined: *Macrobathra diplochrysa* Low., *Ochlogenes advectella* Walk., *Borkhausenia hemisphaerica* Meyr., *B. pseudospretella* Stt., *B. basella* Walk., *Machimia carnea* Z., *M. zatrephes* Turn., *Eulechria baryptera* Turn., *Barea leucocephala* Turn., *Piloprepes lophoptera* Low., *Machaeritis aegrella* Meyr., *Coesyra paulinella* Newm., *C. apora* Meyr., *C. dichroella* Z., *Oxythecta acceptella* Walk., *Coeranica isabella* Meyr., *Pleurota psammoxantha* Meyr., *Saropla philocala* Meyr., *Protomacha chalcaspis* Meyr., *Chezala conjunctella* Walk., *Philobota xiphostola* Meyr., *P. disjunctella* Walk., *Lophopepla igniferella* Walk., *Zonopetala clerota* Meyr., *Callithauma pyrites* Meyr., *Eupselia satrapella* Meyr., *Eutorna pabulicola* Meyr., *Thudaca obliquella* Walk., *Endorsis lactella* Schiff., *Schiffermuelleria orthopanes* Meyr. *Leptocroca meselectra* Meyr., *Euchersadaula lathriopa* Meyr., *Euthictis chloratma* Meyr., *Trachypepla contritella* Walk., *Izatha epiphanes* Meyr., *Proteodes carnifex* Butl., *Lathicrossa leucocentra* Meyr., *Atomotricha chloronota* Meyr., *A. exsomnis* Meyr., *Thamnosara sublitella* Walk., *Cryptolechia liochroa* Meyr., *C. radiosella* Walk., *Nymphostola galactina* Feld., *Wingia lambertella* Wing.

XYLORYCTIDAE (Figs. 72 to 77).

Good examples of progressive reduction in the maxillary palpi are exhibited in this large family. *Lichenaula* has a five-segmented palp; the genera *Telecrates, Odites, Procometis, Agriophora, Chalarotona, Scieropepla, Eschatura, Uzucha,* and *Catoryctis* have each lost a segment; *Xylorycta* and *Maroga* have only three remaining; *Cryptophaga rubescens* has two, with a third represented by a minute papilla, while in *C. nubila* this papilla has been lost. In *Neodrepta* the third segment is elongate, curved and medially constricted, having all the appearance of being the result of the fusion of the third and fourth. Bearing in mind the shape and size of the apical segment in the majority of the genera, it would appear that reduction has usually taken place by the loss of median or basal segments; and in some genera, i.e., *Telecrates, Agriophora,* etc., the evidence points pretty conclusively to the basal one as having disappeared. In *Neodrepta,* however, the original basal segment is almost certainly present, and the evidence seems to warrant the conclusion that here the loss of a segment has been brought about by the fusion of two, such fusion

being a preliminary to the shortening of the structure. The cardo and stipes are of normal form and chitinization. The haustellum is short but its two halves are always closely fitted to each other, and the organ is doubtless functional. On the apical half it bears a number of prominent sensory papillae. In *Cryptophaga* the haustellum shows its greatest reduction, and here also the maxillary palpi are most vestigial.

Species examined: *Lichenaula lichenea* Meyr., *Telecrates laetiorella* Walk., *Odites pudica* Low., *Eschatura lemurias* Meyr., *Chalarotona intatescens* Meyr., *Scieropepla reversella* Walk., *Catoryctis eugramma* Meyr., *Procometes hylonoma.*, *Agriophora confertella* Walk., *Uzucha humeralis* Walk., *Maroga unipunctana* Don., *Xylorycta melaleuca* Turn., *Cryptophaga rubescens* Lew., *C. nubila* Luc., *Neodrepta luteotactella* Walk.

Gelechiidae (Figs. 78 and 79).

The structure of the maxillae in the Gelechiidae is very uniform. The cardo is small, the stipes normal, the haustellum very well developed, though not elongate, and the palpi usually four-segmented. These latter take up the same position as in the Oecophoridae but are not so closely appressed to the base of the haustellum. The segments are all short; the third is usually curved and is the shortest of the four, while the apical one is generally the largest and is slightly swollen. Out of fourteen genera examined this description holds good, but in *Apatetris* the palp was found to consist of three minute globular segments.

Species examined: *Aristotelia furtiva* Meyr., *Anacampsis simplicella* Walk., *Macrenches clerica* Rosen., *Stegasta variana* Meyr., *Phthorimaea operculella* Z., *Anaptilora eremias* Meyr., *Crocanthes perigrapta* Meyr., *Lecithocera micromela* Low., *Protolechia micropa* Meyr., *Cymatomorpha euplecta* Meyr., *Dichomeris capnitis*, Meyr., *Thiotricha tetraphala* Meyr., *Gelechia monophragma* Meyr., *Apatetris melanombra* Meyr.

Cosmopterygidae (Figs. 80 to 83).

This family has a well-developed haustellum and a four-segmented maxilliary palp. The segments of the palp are, however, very short: the apical one is usually swollen and covered with rather long scales. The cardo is comparatively large.

Species examined: *Cosmopteryx mimetis* Meyr., *Pyroderces deliciosella* Walk., *Glaphyristis marmarea* Meyr., *Trachydora droserodes* Meyr.

Diplosariidae (Fig. 84).

Only one example of this family has been examined. This species, *Irenicodes eurychora* Meyr., the only known New Zealand representative of the group, is said by its describer to be a rather highly specialized member. The haustellum is well developed but the maxillary palpi are greatly reduced, consisting only of three small segments.

Species examined: *Irenicodcs eurychora* Meyr.

EUCOSMIDAE (Figs. 85 to 87).

The few Eucosmids which I have been able to study all exhibit, with the exception of *Bactra*, a thick, though not very long, haustellum, and a maxillary palp consisting of three fairly stout segments. The anterior face of the basal segment is rounded and swollen, and bears a number of hairs; the other two segments may be irregular, as in *Eucosma*, or more symetrical, as in *Argyroploce*. In *Bactra* there are but two small globular segments, the apical one being about half the size of the basal one.

Species examined: *Eucosma triangulana* Meyr., *Agryroploce illepida* Butl., *Cydia pomenella* L., *Spilonota macropetana* Meyr., *Bactra noteraula* Wlshm.

TORTRICIDAE (Figs. 88 to 92).

The maxillae of this important family do not call for much remark. The cardo, stipes, and haustellum are all well developed and of normal shape. The maxillary palpi are usually three-segmented, but the segments are short and generally more or less elongate-oval. A fairly constant feature is a rounded prominence on the inner surface of the basal segment from which springs a number of hairs. In a few instances there is a minute fourth apical segment and more frequently the number is reduced to two. The number of segments is not necessarily a generic character as *Tortrix* exhibits all three variations.

Species examined: *Tortrix amoenana* Walk., *T. liquidana* Meyr., *T. postvittana* Walk., *T. crypsibodes* Meyr., *T. pictoriana* Feld., *T. excessana* Walk., *T. flavescens* Butl., *Harmologa amplexana* Z., *Gelophaula siraea* Meyr., *Cacoecia polygraphana* Walk., C. *australana* Lew., *Acropolitis rudis* Walk., *Ctenopseustis obliquana Walk.*, *Epalxiphora axenana* Meyr., *Epichorista emphanes* Meyr., *Pyrgotis pyramidias* Meyr., *Proselena antiquana* Walk., *Catamacta gavisana* Walk., *Capua intractana* Meyr., *Cnephasia rupicolana* Meyr., *Homona similans* Walk., *Scolioplecta comptana* Walk.

CARPOSINIDAE (Fig. 93).

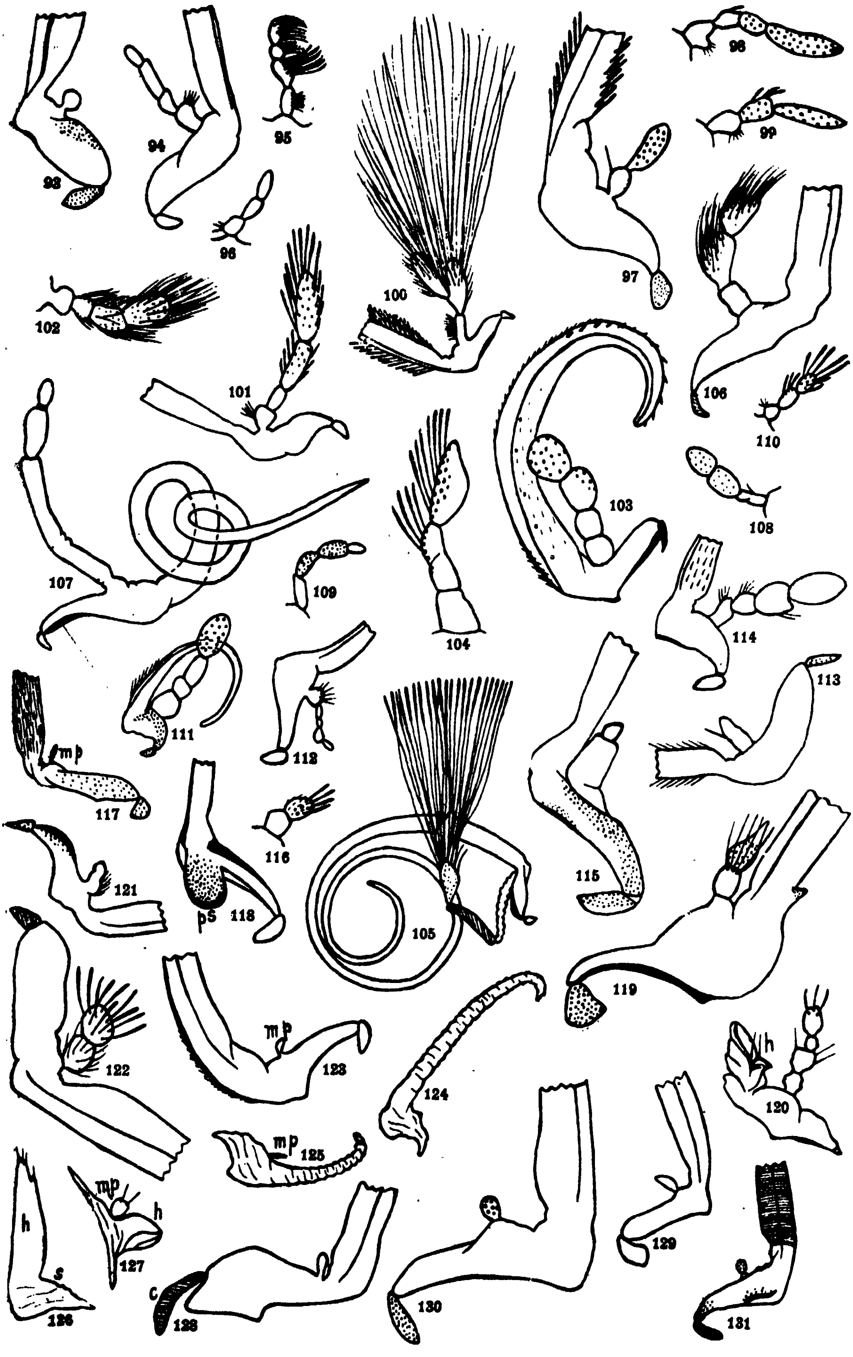
The two genera examined of this family had the maxillary palpi reduced to a single small rounded segment. The haustellum was well developed and the other parts normal.

Species examined: *Carposina gonosemana* Meyr., *Heliocosma incongruana* Walk.

PRALIDIDAE.

PYRAUSTINAE (Figs. 94 to 96).

In this large subfamily the maxillary palpi seem to be normally four-segmented though in two genera, *Sceliodes* and *Musotima*, only three segments are present. The basal segment usually bears an anterior rounded protuberance which is always armed with a group of short spines. The third and fourth segments are generally densely clothed with long scales and in a few forms, such as *Agrotera* and *Sameodes*, these are replaced by elongate hairs directed rectangularly to the segment. In Nacoleia the segments are subglobular and minute,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FIGS. 93-131.

and in *Dichocrocis* they are of similar form but larger in proportion. The haustellum is long and well developed being shortest in *Nymphula* where it is about thrice as long as the palpi.

Species examined: *Nymphula dicentra* Meyr., *Cataclysta drusialis* Walk., *Musotima acrias* Meyr., *Eurrhyparodes tricoloralis* Z., *Ercta ornatalis* Dup., *Agrotera amathealis* Walk., *Dichocrocis punctiferalis* Guen., *Nacoleia rhoeonalis* Walk., *B. Bradina admixtalis* Walk., *Sylepta derogata* Fabr., *Margaronia atlitalis* Walk., *Marasmia venilialis* Walk., *Sameodes iolealis* Walk., *Loxostege massalis* Walk., *Metasia capnochroa* Meyr., *Acharana licarsisalis* Walk., *Pyrausta phoenicealis* Hb., *Mecyna ornithopteralis* Guen., *Heliothela floricola* Turn., *Scoparia favillifera* Meyr., *S. philerga* Meyr., *Tetraprosopis meyricki* Butl., *Euclastis maceratatalis* Led., *Nausinoe pueritia* Cram., *Diasemia grammalis* Dbld., *Nesarcha hybrealis* Walk., *Sceliodes cordalis* Dbld.

FIG. 93.—*Carposina gonosemana* Meyr. Maxilla.
FIG. 94.—*Cataclysta drusialis* Walk. Maxilla.
FIG. 95.—*Agrotera amathealis* Walk. Maxillary palp.
FIG. 96.—*Musotima acrias* Meyr. Maxillary palp.
FIG. 97.—*Scenedra decoratalis* Walk. Maxilla.
FIG. 98.—*Trichophysetis cretacea* Butl. Maxillary palp.
FIG. 99.—*Spectatrota fimbrialis* Warr. Maxillary palp.
FIG. 100.—*Macalla concisalis* Walk. Maxilla.
FIG. 101.—*Crambus malacellus* Dup. Maxilla.
FIG. 102.—*Ubida ramostriella* Walk. Maxillary palp.
FIG. 103.—*Eucallionyma sarcodes* Meyr. Maxilla.
FIG. 104.—*Heteromicta tripartitella* Meyr. Maxillary palp.
FIG. 105.—*Epicrocis sublignalis* Walk. Male, Maxilla.
FIG. 106.—*E. sublignalis* Walk. Female, Maxillary palp.
FIG. 107.—*Papua rhabdota* Turn. Maxilla.
FIG. 108.—*Hypsotropha chlorogramma* Meyr. Maxillary palp.
FIG. 109.—*Delogenes limadoxa* Meyr. Maxillary palp.
FIG. 110.—*Homoeosoma formacella* Meyr. Maxillary palp.
FIG. 111.—*Scirpophaga patulella* Walk. Maxilla.
FIG. 112.—*Orneodes phricodes* Meyr. Maxilla.
FIG. 113.—*Alucita monospilalis* Walk. Maxilla.
FIG. 114.—*Coenoloba obliteralis* Walk. Maxilla.
FIG. 115.—*Morova subfasciata* Walk. Maxilla.
FIG. 116.—*Addea subtessellata* Walk. Maxillary palp.
FIG. 117.—*Euschemon rafflesia* Macleay. Maxilla.
FIG. 118.—*Zizina labradus* Godart. Maxilla.
FIG. 119.—*Synemon directa* Westw. Maxilla.
FIG. 120.—*S. hesperoides* Feld. Female, maxilla.
FIG. 121.—*Pollanisus iridescens* B-B. Maxilla.
FIG. 122.—*Zygaena filipendulae* L.
FIG. 123.—*Nyctalemon orontes* L. Maxilla.
FIG. 124.—*Porthesia fimbriata* Luc. Maxilla.
FIG. 125.—*Acyphas chionites* Turn. Maxilla.
FIG. 126.—*Orgyia australis* Walk. Female, Maxilla.
FIG. 127.—*Lymantria reducta*, Walk. Maxilla.
FIG. 128.—*Hippotion celerio* L. Maxilla.
FIG. 129.—*Xanthorhoe rosearia* Dbld. Maxilla.
FIG. 130.—*Digama marmorea* Butl. Maxilla.
FIG. 131.—*Hecatesia fenestrata* Boisd. Maxilla.

LETTERING.

c, cardo; *g*, galea; *h*, haustellum; *hy*, hypopharynx; *l*, lacinia; *lp*, labial palp; *lpl*, first segment of labial palp; *lr*, labrum; *m*, maxilla; *mp*, maxillary palp; *mt*, mental plate; *mxt*, maxillary tentacle; *ps*, process of stipes; *s*, stipes.

Pyralidinae (Figs. 97 to 100).

In the Pyralidinae there is much variation in the maxillary palpi. In *Scenedra* and *Endotricha* there are but two segments while in *Trichophysetis, Herculia* and *Cardamyla* there are four. In the latter instances the second and third segments are so closely set that they appear as one structure and in *Spectatrota* it would seem that the fusion of the two segments had taken place, there being but three pieces and the second having an indentation which probably marks the line of fusion. *Macalla* has an extraordinarily modified maxillary palp. It consists of three well-developed segments, the third of which articulates laterally close to the base of the second. These two segments are clothed with a dense tuft of long fine hair. In all the genera examined the haustellum stipes and cardo were found to be of normal proportions.

Species examined: *Trichophysetis cretacea* Butl., *Herculia albidalis* Walk., *Cardamyla didymalis* Walk., *Macalla concisalis* Walk., *Spectatrota fimbrialis* Warr., *Scenedra decoratalis* Walk., *Endotricha mesenteralis* Walk.

Crambinae (Figs. 101 and 102).

In the Crambinae there is not much variability in the parts of the maxillae. The maxillary palpi, in so far as my observations have been carried out, are always four-segmented, the shape of the segments varying from the short form of *Ubida* to the longer and more slender kind of *Crambus,* the apical segment or segments being invariably slightly swollen. The haustellum is usually well developed, but in a few instances it shows some reduction, and in *Calamotropha* it is not twice the length of the palp.

Species examined: *Crambus dicrenellus* Meyr., *C. malacellus* Dup., *Orocrambus mylites* Meyr., *Argyria amoenalis* Snel., *A. plumbolinealis* Hmpsn., *Talis bivitella* Don., *Chilo lativittalis* Walk., *Neargyria argyraspis* Meyr., *Tauroscopa gorgopis* Meyr., *Ubida ramostriella* Walk., *Diptychophora ochracealis* Walk., *Gadira acerella* Walk., *Calamotropha parramattellus* Meyr.

Galleriinae (Figs. 103 and 104).

The two genera, *Eucallionyma* and *Heteromicta,* of this subfamily, which are all that have been examined, differ a great deal in the character of the maxillae. Both have a four-segmented palp, but the form of the segments differs considerably. The haustellum in *Eucallionyma* is reduced to an apparently non-functional vestige and the cardo and stipes are also greatly atrophied. In *Heteromicta,* however, the haustellum is well developed and the cardo and stipes quite normal.

Species examined: *Eucallionyma sarcodes* Meyr., *Heteromicta tripartitella* Meyr.

Phycitinae (Figs. 105 to 110).

In the Phycitinae the haustellum is somewhat weak, and is apparently undergoing reduction. The maxillary palp in some genera, e.g., *Homoeosoma, Sclerobia,* and *Crocydopora,* consist of three short segments; in *Hypsotropha* it is difficult to decide whether there are three

or four, the basal segment being very weakly chitinized and showing certain indications of being the result of fusion of the first and second segments. In *Delogenes* there are undoubtedly four rather short segments; here again the basal segments is more or less membranous, but there is no evidence of fusion. *Papua* has developed a very unusual type of palp, the first and second segments being extremely long, very weakly chitinized, and with the division merely indicated. *Epicrocis* has one of the most remarkable maxillary palps to be found in the Lepidoptera. The organ is four-segmented, the basal segment being long, membranous, and flexible. It droops downwards from the stipes, but the second segment, which is well chitinized, is directed sharply upwards. This segment is about the same length as the first, both being thin in comparison to their length. The third and fourth are short, the former being clavate and the latter cone-shaped. From the last two segments arise a great number of extremely long hairs. These hairs are slightly thickened at their apices, and being all of about the same length form a pair of truncated stiff brushes which lie immediately behind the upturned labial palpi. These very remarkable palpi are, however, confined to the male, the female having a three-segmented organ of ordinary structure.

Species examined: *Delogenes limodoxa* Meyr., *Papua rhabdota* Turn., *Hypsotropha chlorogramma* Meyr., *Epicrocis sublignalis* Walk., *Homoeosoma formacella* Meyr., *Sclerobia tritalis* Walk., *Crocydopora cinigerella* Walk.

SCHOENOBINAE (Fig. 111).

Two genera of this group have been examined. The haustellum is greatly reduced; in *Cirrochrista* it is a little more than twice as long as the maxillary palp and in *Scirpophaga* it is only about half as long again. The palp is four-segmented, the segments being rather short and thick, and the stipes and cardo are small and of an unusual curved shape. The whole organ exhibits much reduction, the palp being the most normal in size and form.

Species examined: *Scirpophaga patulella* Walk., *Cirrochrista trizonalis* Walk.

ORNEODIDAE (Fig. 112).

Only one species, *Orneodes phricodes* Meyr., has been examined. The haustellum is of moderate development, and the cardo and stipes are normal. The maxillary palp consists of five greatly-reduced segments. The basal one is the largest, and bears the usual group of spines on its anterior surface; the second and third are less than half the size of the first; the fourth is considerably larger and more or less globular, while the fifth is minute and set at an angle to the fourth.

Species examined: *Orneodes phricodes* Meyr.

TINEODINIDAE (Fig. 114).

Coenoloba, the only genus studied, has a well-developed haustellum and a four-segmented maxillary palp. The latter is somewhat clavate, the two apical segments being considerably broader than the basal ones.

Species examined: *Coenoloba obliteralis* Walk.

Pterophoridae (Fig. 113).

In the plume-moths the maxillary palp is represented by a single papilla, usually armed on the anterior aspect with a spine or spines. In some genera it is rather long, and possibly more than one segment is present, but no definite division can be seen. The haustellum is generally long and the other parts are normal.

Species examined: *Alucita monospilalis* Walk., *Platyptilia falcatalis* Walk., *Trichoptilus adelphodes* Meyr., *Stenoptilia lithoxesta* Meyr., *Sphenarches caffer* Z.

Thyrididae (Figs. 115 and 116).

In the Thyrididae, of which five genera have been examined, the haustellum is fully developed, as also are the stipes and cardo, but the palp is far on the road to disappearance. In *Striglina* the structure is represented by a conical papilla only; in *Morova* and *Oxycophina* a similar papilla has a small rounded segment on its apex; in *Addaea* and the aberrant *Meskea* the palp consists of two very small but more normal segments.

Species examined: *Addaea subtessellata* Walk., *Meskea dyspteraria* Grote, *Morova subfasciata* Walk., *Oxycophina theorina* Meyr., *Striglina scitaria* Walk.

Papilionoidea (Figs. 117 and 118).

Of the butterflies I have examined such a small number of species that any observations offered must be regarded as strictly provisional. The haustellum in this group is well developed and very strongly chitinized, as also are the cardo and stipes. In the Hesperidae the maxillary palp consists of a single minute segment articulating by a slender base. A similar structure is found in the Satyridae, and a still smaller one in the Nymphalidae. In the Papilionidae the palp is merely indicated by a blunt protuberance (probably the palpifer) bearing a tuft of hair, while in the Pieridae and Lycaenidae all trace of the palp has been lost. The Lycaenidae, and in a lesser degree, the Papilionidae, exhibit an unusual modification of the stipes. From the apical region of the stipes beneath, a bulb-like swelling projects in a line with the haustellum. It is smooth and very strongly chitinized, and has the appearance of a condyle, but I have not found that it fits into any corresponding socket.

Species examined: *Euschemon rafflesia* Macleay, *Pamphila hobomoc*, *Signeta tymbophora* Meyr. and Low., *Motasingha dominula* Ploetz, *Cephrenes augiades* Feld., *Dodonidia helmsi* Frdy., *Argyrophenga antipodum* Dbld., *Pyrameis gonerilla* Fabr., *P. cardui* L., *Papilio brucei* Edwards, *P. macleayanus* Leach, *Delias mysis* Fabr., *Zizina labradus* Godart.

Castniidae (Figs. 119 and 120).

Synemon hesperoides Feld. has the maxillae much reduced. The haustellum is represented only by a short, shrivelled, and irregular process; the cardo is minute, and the stipes much altered; the palp, however, still consists of four segments, though they are weak and irregular in shape. Contrary to what would be expected, the maxillae

of *S. directa* Westw. shows a fairly normal structure. The haustellum is quite well developed; the cardo is large and well chitinized; the stipes normal and the palpi symmetrical though consisting of but two segments. The second segment, however, has the apical half produced into a membranous point, and it is not improbable that this represents the third segment which has become fused with the second. A peculiar feature of the haustellum is the presence of a ridge or fold near the base beneath. The vestigial state of the haustellum in *hesperoides* is no doubt connected with the feeding-habits of the species and Australian lepidopterists might be able to throw some light on the matter by closely observing the habits of both *hesperoides* and *directa* in this respect.

Species examined: *Synemon directa* Westw., *S. hesperoides* Feld.

ZYGAENIDAE (Figs. 121 and 122).

The haustellum in the Zygaenidae is unusually long, but the maxillary palp is reduced to a one- or two-segmented vestige. The cardo and stipes are normal and well chitinized.

Species examined: *Pollanisus iridescens* B-B., *Zygaena filipendulae* L.

LASIOCAMPIDAE.

Only two species belonging to this family have been examined. In both instances the maxillae were found to be absent.

Species examined: *Entometa fervens* Walk., *Porela arida* Walk.

NOTODONTIDAE.

In *Neola* the cardo, stipes and haustellum were found to be well developed and the maxillary palpi to consist of two small segments, but in *Epicoma* the maxillae seemed to be entirely absent. Packard, in his monograph of the North American species of the family (*Nat. Acad. Sci.* vol. 7, p. 87) states that the maxillary palpi form "small papillae at the base of the maxillae" (galeae).

Species examined: *Neola semiaurata* Walk., *Epicoma tristis* Lew.

URANIIDAE (Fig. 123).

Three genera only of this family have been examined. They agree in having the haustellum fairly well developed, the cardo and stipes normal and the maxillary palpi reduced to one tiny segment.

Species examined: *Nyctalemon orontes* L., *Acropteris nanula* Warr., *Lobogethes interrupta* Warr.

SATURNIIDAE.

In the only species dissected the maxillae were found to be reduced to a weakly chitinized irregular vestige lying at the base of the small labial palpi.

Species examined: *Antherea eucalypti* Scott.

ANTHELIDAE.

The maxillae are reduced to a wrinkled and irregular membranous vestige. One or two papillae are present, but it is not possible to definitely relate these to any part of the normal maxillae.

Species examined: *Anthela varia* Walk., *A acuta* Walk.

Lymantriidae (Figs. 124 to 127).

The maxillae here are much reduced in all their parts. The organs are only slightly, if at all, chitinized, and are much crinkled. The cardo is frequently absent and the stipes is short and irregular in shape. The palp is sometimes absent, and sometimes present as a minute papilla. In *Laelia,* however, the cardo and stipes are normal in shape and have a chitinized core while the haustellum is fairly long and but little crinkled. In *Orgyia* the female is apterous, and it is interesting to find that the sexes differ also in the maxillae. The male has the organs greatly reduced but of the same form as those of *Euproctes*; in the female the haustellum is straight, and the apex terminates in two or three papillae, each bearing a hair; there is also a similar papilla a little distance below the apex. *Lymantria* exhibits the greatest reduction of any genus dissected, there being distinguishable only the base of the haustellum and a rounded tubercle representing the maxillary palp.

Species examined: *Laelia obsoleta* Fabr., *Porthesia fimbriata* Luc., *P. lutea* Fabr., *Acyphas chionitis* Turn., *Orgyia australis* Walk., *Lymantria reducta* Walk.

Sphingidae (Fig. 128).

In the hawk-moths the parts of the maxillae, with the exception of the maxillary palpi, are well developed and very strongly chitinized. The haustellum in most forms is of abnormal length, but in a few instances it is reduced to a vestige. In the few genera examined the stipes was found to be broadened basally, roundly projecting beneath the curved cardo in a way not observed in any other lepidopteron. The maxillary palp was in all instances reduced to a single small segment.

Species examined: *Hippotion celerio* L., *Metamima australasiae* Don., *Deilephila hypothous* Cram., *Theretra pinastrina* Martyn, *Hemaris hylas* Lew.

Geometroidea (Fig. 129).

In the families composing this group the maxillae display very little variation. The haustellum is well developed though not long, the stipes is rather narrow and the cardo fairly large, but the maxillary palp consists of a single small, more or less rounded segment. Prout (Genera Insectorum, fasc. 103, p. 7) states that in *Ligdia* (Brephinae) the palp consists of two segments.

Species examined: *Chloroclystis testulata* Guen., *Tatosoma tipulata* Walk., *Mnesiloba eupitheciata* Walk., *Euchoeca rubropunctaria* Dbld., *Eulype leucophragma* Meyr., *Protaulaca scythropa* Meyr., *Poecilasthena subpurpureata* Butl., *Hydriomena deltoidata* Walk., *H. subrectaria* Dbld., *Horisme peplodes* Turn., *Xanthorhoe rosearia* Dbld., *X. orophylla* Meyr., *Lythria chrysopeda* Meyr., *Notoreas mechanitis* Meyr., *Dasyuris hedylepta* Turn., *Leptomeris rubraria* Dbld., *L. optivata* Walk., *Eois albicostata* Walk., *Gnamptoloma aventiaria* Guen., *Anisodes pallida* Moore, *Pisoraca niveopuncta* Warr., *Euloxia meandiaria* Guen., *Chlorocoma dichoraria* Guen., *Prasinocyma albicosta* Walk., *Urolitha bipunctifera* Walk., *Eucyclodes pieroides* Walk.,

Crypsiphona occultaria Don., *Euschema fenestrata* Swain., *Eucryphia frontisignata* Walk., *Dichromodes consignata* Walk., *Epidesmia chilon aria* Guen., *Adeixis griseata* Huds., *Monoctenia pallida* Luc., *Osteodes procurata* Walk., *Cleora inflexaria* Snel., *Lophodes sinistraria* Guen., *Ectropis fractaria* Guen., *Deilinea rectaria* Walk., *Rhinodia rostraria* Guen., *Idiodes apicata* Guen., *Planolocha autoptis* Meyr., *Thalaina clara* Walk., *Declana leptomeris* Walk.

HYPSIDAE (Fig. 130).

In the Hypsidae all the parts of the maxillae except the palp, which is one-segmented are well developed and strongly chitinized, the cardo being unusually large.

Species examined: *Nyctemera amica* White, *Digama marmorea* Butl., *Argina cribraria* Clerck, *Hypsa plagiata* Walk., *Agape chloropyga* Walk.

NOCTUIDAE (Fig. 131).

In the great family Noctuidae examples of all the sub-families except the Hyblaeinae have been studied. Throughout the group the maxillae are almost uniform in structure. The haustellum, though not usually very long, is stout and well chitinized; the cardo and stipes are also well developed, and the maxillary palp is always one-segmented but is frequently mounted on a pronounced palpifer. Comstock *(An Introduction to Entomology,* p. 655) states that the maxillary palpi of the Hyblaeinae are " large and triangular " but he gives the group family rank, placing it next to the Thyrididae.

Species examined: *Phalaenoides tristifica* Hb., *Hecatesia fenestrata* Boisdv., *Apina callista* Walk., *Canthylidia moribunda* Guen., *Agrotis ypsilon* Rott., *Eumichtis saliaris* Guen., *Persectania ewingii* Westw., *Melanchra ustistriga* Walk., *Spodoptera umbraculata* Walk., *Cosmodes elegans* Don., *Araeoptera canescens* Walk., *Eublemma cochylioides* Guen., *Eustrotia ritsemae* Snel., *Bombotelia jocosatrix* Guen., *Nanaguna breviuscula* Walk., *Donuca memorabilis* Walk., *Parallelia constricta* Butl., *Dasypodia selenophora* Guen., *Hypena scabra* L., *Palthis dugulalis* Hb.

ARCTIIDAE.

In the Arctiidae the haustellum may vary from the strongly chitinized and well developed organ of *Rhodogastria* to the non-functional and weakly-vestigial structure in *Ardices*. In all grades, however, the maxilliary palp remains the same; it is minute, generally rounded, and consists of a single segment. The cardo and stipes are much the same as those of the Noctuidae.

Species examined: *Celama fraterna* Moore, *Lexis nitens* Walk., *Calamidia hirta* Walk., *Scaptesyle monogrammaria* Walk., *Asura lydia* Don., *Comarchis staurocola* Meyr., *Ardices curvata* Don., *Creatonotus gangis* L., *Rhodogastria crokeri* Macleay.

SYNTOMIDAE.

The Syntomidae resemble the normal Arctiids in the structure of the maxillae but the organs are exceptionally strongly chitinized.

Species examined: *Syntomis annulata* Fabr., *Euchromia creusa* L.

From the preceding survey it will be seen at once that as far as the more generalized groups of Lepidoptera are concerned, the maxillae, and more particularly the maxillary palpi, form a valuable structure for purposes of classification. In the higher groups, such as the Geometroidea and Noctuoidea, the palp, having been reduced to a simple vestige, is of little systematic value, but in the lower groups, where such reduction is in process of being carried out, the state of the organ may often furnish decisive data as to relationships. It seems probable that the function of the maxillary palp in the early mandibulate Lepidoptera was of a tactile nature. As the galeae began to take on the function of a sucking organ the palpi would still be useful as tactile structures, but as the haustellum grew longer the usefulness of the palpi in this direction would decline. Also, sensory hairs and spines began to be developed on the haustellum itself, thus rendering the organ independent of the tactile functions of the palpi. In accordance with nature's invariable custom, the useless structure began to atrophy, the process being carried on over a very extended period. It is this slow process of reduction which gives systematic value to the condition of the palp. It is extremely improbable that the organ, having once lost one or more segments, should regain them, and thus, if in a given group of Lepidoptera certain genera have a three-segmented palp while others have a four-segmented one, the former can be set down with confidence as not having been ancestral to any of the latter. Thus, the Pyralididae, with a four-segmented palp, could not be derived from the Thyrididae, with at most a two-segmented organ; nor, in the Papilionoidea, could the Pieridae, with no trace of the maxillary palp, have given rise to the Nymphalidae or the Satyridae, both of which have a one-segmented palp. These instances, however, apply only so far as the evidence of the present investigation goes, and are merely to be considered as illustrations of the principle; examination of other genera might destroy their force. It is not, of course, proposed that a system of classification should be based solely on the maxillary palpi—no system can be satisfactory which does not take cognisance of the whole structure of an organism—but it is suggested that the maxilla, and its palp in particular, may frequently be the deciding factor when other data fail to lead to a definite conclusion.

In conclusion I desire to express my best thanks to those who have assisted me with material. I am deeply indebted to Messrs. G. V. Hudson and S. Lindsay of the Dominion; to Drs. Eyer and Schaus of the United States; to Mr. Keppel H. Barnard of South Africa; to Mr. Geo. Lyell of Victoria; and lastly and chiefly to Dr. A. Jefferis Turner of Queensland. Dr. R. J. Tillyard has been kind enough to read and criticise the completed paper, and I have also derived much help from a study of his article, "On the Mouth-parts of the Micropterygoidea" in *Trans. Ent. Soc. Lond.*, 1923, p. 181.

New Zealand Fungus Gnats (*Diptera, Mycetophilidae*)

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PLATES 58-80.

INTRODUCTION.

THE Mycetophilidae form a very important part of the dipterous fauna of New Zealand, both as regards the number of species and the number of individuals. They are found sometimes in amazing quantity in the bush along shady gullies and creeks, below overhanging ferns and mosses, on the small undergrowth, or on the tree trunks. They are more seldom met with in the open country; however, some large species of *Platyura* and *Nervijuncta* may be found in the tussock-land above the forest-line, or among the grass in the cultivated area, together with a few ubiquitous species of *Mycetophila, Zygomyia,* and *Anomalomyia.*

Very few of the larvae of the New Zealand species are known; even the most striking of all, that of *Arachnocampa luminosa,* or glow-worm, would require serious investigations before all the points of its interesting life-history could be settled.

The Mycetophilidae may be distinguished from the other families of nematocerous Diptera by the following characters:

1. Presence of strong and well-developed tibial spurs.
2. Two or three ocelli, the lateral ones often contiguous with the eye-margins.
3. Strong bristles on the body and sometimes on the legs.
4. Reduction or absence of pulvilli.
5. Antennae inserted always well above the oral margin.
6. Absence of vein R_{2+3} and of discoidal cell; vein A always incomplete if not altogether absent.

The venation is of the greatest importance for the classification of the different sub-families and genera; the notation employed here is that of Comstock and Needham, and a certain number of photographic reproductions and drawing of wings have been lettered accordingly, so that no further details on this point will be necessary here.

The wing-membrane may be provided with two sets of hairs, the coarse ones or *macrotrichia,* and the very fine microscopical ones or *microtrichia.* They are in some cases present at the same time, but more often the macrotrichia are partially or completely absent; however, in a few instances they entirely replace the microtrichia; these last may be irregularly arranged on the membrane or else form rather regular longitudinal rows.

The thoracic chaetotaxy also offers a very valuable help for the classification of genera and even of species; a side-view of the thorax of an hypothetical type is given in Fig. A, in which the different sclerites have been named; the bristles and hairs derive their name from the sclerite on which they are placed.

The legs are covered with very fine setae and usually also with more or less strong bristles. The fine tibial setae may be arranged in very regular straight longitudinal rows, or else simply scattered over the whole surface of the tibia. The tibial bristles are sometimes arranged in two rows, but also in three or four rows, and the number of bristles in each row may be quite constant in a given species; these rows have received a name according to their position on the tibiae: dorsal, ventral, external, or internal. The tibiae are often provided with one or sometimes with two little combs on their extremity. The empodium is not always present in certain groups, and is, therefore, of taxonomic importance.

HISTORICAL.

Up till now only 39 species of Mycetophilidae were known from New Zealand; these were distributed in 19 genera.

The first three species were described by Hutton in his " Catalogue of N.Z. Diptera, Orthoptera and Hymenoptera " 1881. They were:

Mycetophila guttata
Patyura tridens
Sciara rufescens.

The first two belong respectively to the genera *Anomalomyia* and *Nervijuncta;* the third is unsufficiently characterized by the description, and as the type is lost this species should be suppressed from the list.

In 1891 Skuse describes *Bolitophila luminosa,* which had been obtained in breeding through the well-known glow-worm by Mr. G. V. Hudson, who gives, in the same paper *(Trans N.Z. Inst.,* vol. 23, p. 47), an account of the life-history of this interesting species.

In 1892 Osten-Sacken (*Berl. Ent. Zeit.,* 27 pp. 432-4) discusses a species of *Nervijuncta* (referred to by him as *Platyura)* and also mentions the occurrence in New Zealand of a species of *Platyroptylon,* which has never been recorded since.

Professor P. Marshall was the first specially to direct his attention to the fungus-gnats of New Zealand, and he embodied the result of his investigations on that family in an important paper *(Trans. N.Z. Inst.,* vol. 28, 1896, p. 250-309) in which 33 new species were described and 10 new genera erected to receive some of them and also some of those previously described by Hutton. However, two of these species fall in synonymy with others of his own, and four of his new genera with some well-known ones from the holarctic region. Here is a list of the species dealt with in this paper:

Cycloneura (n. gen.) *hudsoni* (gen. *Nervijuncta* Marsh.);
Nervijuncta (n. gen.) *nigrescens;*
Huttonia (n. gen.) *tridens* Marsh.;
Macrocera montana = *howletti;*

Macrocera antennalis;
Macrocera scoparia;
Ceroplatus dendyi (gen. *Cerotelion* Rond.);
Ceroplatus hudsoni;
Ceroplatus leucoceras;
Platyura magna;
Platyura agricola;
Platyura flava (name preoccupied);
Sciophila fagi (gen. *Aneura* Marsh.);
Sciophila hirta (gen. *Taxicnemis* nov.);
Parvicellula (n. gen.) *triangulata;*
Tetragoneura nigra;
Aneura (n. gen.) *boletinoides;*
Cycloneura (n. gen.) *flava;*
Paradoxa (n. gen.) *fusca;*
Euryceras (n. gen.) *anaclinoides* (gen. *Allocotocera* Mik.);
Anomala (n. gen.) *guttata* Hutt. (gen. *Anomalomyia* Hutt.);
Anomala minor;
Aphelomera skusei;
Zygomyia flavicoxa;
Zygomyia fusca;
Brachydicrania hiemalis (gen. *Exechia* Winn.);
Mycetophila sylvatica;
Mycetophila howletti;
Mycetophila fagi = *variabilis* = *robusta;*
Mycetophila maculata (name preoccupied);
Brevicornu (n. gen.) *flava* (gen. *Allodia* Winn.).

His types, mostly in good condition, are preserved in the collection of the Cawthron Institute.

A few years later, in a paper on New Zealand Diptera *(Trans. N.Z. Inst.*, vol. 34, 1901, p. 192) Hutton describes two species of Sciarinae: *Sciara marcilla* and *Trichosia remota.* A study of the type of the latter shows that it belongs to the genus *Lestremyia* (Cecidomyiidae) and has consequently to be removed from the list of N.Z. Mycetophilidae.

In his " Index Faunae Novae Zealandiae " 1901, Hutton proposes three new generic names: *Arctoneura, Casa,* and *Anomalomyia,* to replace respectively *Cyrtoneura, Huttonia,* and *Anomala,* which were preoccupied.

D. Miller under the title " A new Fungus Gnat which Fertilizes *Corizantes Oblonga* " *(N.Z. Journ. Sc. & Tech.*, 1918, vol. 1, p. 4), describes *Exechia thomsoni,* a species which is unsufficiently characterized and the type of which has been unfortunately lost.

In 1911 Enderlein *(Stett. Ent. Zeit.*, vol. 72, p. 174) changes *Mycetophila maculata* Marsh into *M. marshalli,* the former name being preoccupied.

In a study on the sub-family Ditomyiinae (*Ann. Mag. Nat. Hist.* (*g*), vol. 7, 1921, p. 435), F. W. Edwards describes, among others, a species of New Zealand *Nervijuncta (Arctoneura): N. Wakefieldi* from the collection of the Oxford Museum.

Quite recently the same author (*Ann. Mag. Nat. Hist.* (9), vol. 14, 1924, p. 175) erects a new genus to receive *Bolitophila luminosa.*

As a result of the study of the very extensive material before us the number of species of New Zealand fungus-gnats is brought from 39 to 267, and that of the genera from 19 to 38.

We give hereunder a complete list of the species, including those that were described previously, and with their synonymy:

DITOMYIINAE

Centrocnemis Phil.
basalis Tonn.
fumipennis Tonn.
tillyardi Tonn.
nitida Tonn.
trivittata Edw.

Nervijuncta Marsh.
Syn. *Cyrtoneura* Marsh.
Casa Hutt.
Arctoneura Hutt.
Huttonia Marsh.
hudsoni (Marsh) [*Cyrtoneura*]
wakefieldi (Edw.) [*Arctoneura*]
tridens (Hutt.) [*Platyura*, *Casa*.]
ruficeps Edw.
parvicauda Edw.
filicornis Edw.
flavoscutellata Tonn.
longicauda Edw.
harrisi Edw.
hexachaeta Edw.
nigricornis Tonn.
osten-sackeni Tonn.
nigrescens Marsh.
bicolor Edw.
pulchella Edw.
marshalli Edw.
punctata Tonn.
nigricoxa Edw.

DIADOCIDIINAE.

Heterotricha Loew.
novae-zelandiae Tonn.

BOLITOPHILINAE.

Arachnocampa Edw.
luminosa (Skuse) [*Bolitophila*]

MACROCERINAE

Macrocera Mg.
scoparia Marsh.
milligani Tonn.
fenestrata Edw.
unipunctata Tonn.
campbelli Edw.
antennalis Marsh.
obsoleta Edw.
hudsoni Tonn.
ngaireae Edw.
fusca Tonn.
gourlayi Tonn.
annulata Tonn.
inconspicua Tonn.
pulchra Tonn.
ruficollis Edw.
glabrata Tonn.
montana Marsh.
Syn. *howletti* Marsh.

Paramacrocera gen. nov.
brevicornis Edw.

CEROPLATINAE

Cerotelion Rond.
leucoceras (Marsh.) [*Ceroplatus*]
dendyi (Marsh.) [*Ceroplatus*]
hudsoni (Marsh.) [*Ceroplatus*]
niger Tonn.
bimaculatus Tonn.
vitripennis Tonn.
tapleyi Edw.

Pseudoplatyura Skuse.
truncata Tonn.

Platyura Mg.
brevis Tonn.
subbrevis Tonn.
albovittata Tonn.
marshalli nom. nov.
Syn. *flava* Marsh.
lamellata Tonn.
proxima Tonn.
brookesi Edw.
novae-zelandiae nom. nov.
Syn. *magna* Marsh.
harrisi Tonn.
philpotti Tonn.
rutila Edw.
maculipennis Tonn.
punctifusa Edw.
carbonaria Tonn.
chiltoni Tonn.
campbelli Tonn.
ruficauda Tonn.

agricola Marsh.
curtisi Edw.
rufipectus Tonn.
ohakunensis Edw.

SCIARINAE.

Sciara Mg.
constricta Edw.
nubeculosa Edw.
xanthonota Edw.
griseinervis Edw.
vicarians Edw.
rufulenta Edw.
ovalis Edw.
contractans Edw.
unicalcarata Edw.
annulata Mg.
zealandica Edw.
jejuna Edw.
philpotti Tonn.
harrisi Edw.
marcilla Hutt.
agraria Felt.
tapleyi Edw.
Scythroprochroa End.
nitida Edw.
Ohakunea gen. n.
bicolor Edw.
Neophnyxia gen. n.
nelsoniana Tonn.

MANOTINAE.

Manota
maorica Edw.

SCIOPHILINAE

MYCOMYIINI

Mycomyia Rond.
flavilatera Tonn.
furcata Edw.
plagiata Tonn.

SCIOPHILINI

Allocotocera Mik.
anaclinoides (Marsh.) [*Euryceras* Marsh.]
cephasi Edw.
dilatata Tonn.
crassipalpis Tonn.
Taxicnemis gen. nov.
hirta (Marsh.) [Sciophila]
flava Edw.
Aneura Marsh.
fagi (Marsh) [Sciophila]
nitida Tonn.
fusca Tonn.
appendiculata Tonn.
bispinosa Edw.
longipalpis Tonn.
longicauda Tonn.
defecta Edw.
bolitenoides Marsh.
pallida Edw.
filiformis Tonn.
Phthinia Winn.
longiventris Tonn.
Parvicellula Marsh.
triangula Marsh.
obscura Tonn.
fascipennis Edw.
apicalis Tonn.
gracilis Tonn.
nigricoxa Tonn.
subhamata Tonn.
hamata Edw.
ruficoxa Tonn.
Aphelomera Skuse.
skusei Marsh.
opaca Tonn.
majuscula Edw.
elongata Tonn.
longicauda Edw.
marshalli Edw.
forcipata Edw.
Neotrizygia gen. nov.
obscura Tonn.
Morganiella gen. nov.
fusca Tonn.

GNORISTINI

Synapha Mg.
apicalis Tonn.
pulchella Tonn.
claripennis Tonn.
gracilis Tonn.
alpina Tonn.
similis Tonn.
cawthroni Tonn.
parva Edw.

LEIINI

Anomalomyia Hutt.
Syn. *Anomala* Marsh.
guttata Hutt. [*Anomala*]
immaculata Edw.
obscura Tonn.
subobscura Tonn.
basalis Tonn.

flavicauda Edw.
affinis Tonn.
thomsoni Tonn.
minor (Marsh.) [*Anomala*]
viatoris Edw.
Paradoxa Marsh.
fusca Marsh.
Cawthronia gen. nov.
nigra Tonn.
Cycloneura Marsh.
flava Marsh.
aberrans Tonn.
triangulata Tonn.
Paracycloneura gen. nov.
apicalis Tonn.
Sigmoleia gen. nov.
melanoxantha Edw.
Tetragoneura Winn.
niger Marsh.
flexa Edw.
obliqua Edw.
spinipes Edw.
fusca Tonn.
proxima Tonn.
minuta Tonn.
minima Tonn.
rufipes Tonn.
distincta Tonn.
venusta Tonn.
obscura Tonn.
opaca Tonn.
Trichoterga gen. n
monticola Tonn.

MYCETOPHILINAE.

Allodia Winn.
Syn. *Brevicornu* Marsh.
fragilis (Marsh) [Brevicornu]
flava (Marsh.)
maculata Tonn.
rufithorax Tonn.
quadriseta Edw.
Exechia Winn.
Syn. *Brachydicrania* Marsh.
hiemalis (Marsh.) [*Brachydicrania*]
novae-zelandiae Tonn.
howesi Edw.
filata Edw.
biseta Edw.
thomsoni Mill.
Mycetophila Mg.
ornatissima Tonn.
sylvatica Marsh.
curtisi Edw.
similis Tonn.
elegans Tonn.
latifascia Edw.
howletti Marsh.
consobrina Tonn.
virgata Tonn.
vulgaris Tonn.
trispinosa Tonn.
elongata Tonn.
minima Edw.
marshalli End.
Syn. *maculata* Marsh.
submarshalli Tonn.
pseudomarshalli Tonn.
marginepunctata, Tonn.
nigripalpis Edw.
nitidula Edw.
nitens Tonn.
pauciseta Edw.
phyllura Edw.
subtilis Tonn.
nigricans Tonn.
diffusa Tonn.
grisescens Edw.
lomondensis Edw.
grandis Tonn.
viridis Edw.
subspinigera Tonn.
fumosa Tonn.
griseofusca Tonn.
pollicata Edw.
luteolateralis Edw.
crassitarsis Edw.
tapleyi Edw.
dilatata Tonn.
colorata Tonn.
clara Tonn.
solitaria Tonn.
filicornis Tonn.
fagi Marsh.
Syn. *variabilis* Marsh.
robusta Marsh.
unispinosa Tonn.
impunctata Edw.
subspinigera Tonn.
furtiva Tonn.
conica Tonn.
integra Tonn.
media Tonn.
spinigera Tonn.

tenebrosa Edw.
subtenebrosa Tonn.
intermedia Edw.
harrisi Edw.
Zygomyia Winn.
immaculata Tonn.
similis Tonn.
bifasciata Tonn.
costata Tonn.
obsoleta Tonn.
nigrohalterata Tonn.
grisescens Tonn.
ruficollis Tonn.
brunnea Tonn.
nigriventris Tonn.
apicalis Tonn.
rufithorax Tonn.
longicauda Tonn.
crassicauda Tonn.
crassipyga Tonn.
guttata Tonn.
varipes Edw.
flavicoxa Marsh.
humeralis Tonn.
marginata Tonn.
acuta Tonn.
albinotata Tonn.
truncata Tonn.
unispinosa Tonn.
eluta Edw.
trifasciata Tonn.
nigrita Tonn.
fusca Marsh.
distincta Tonn.
filigera Edw.
penicillata Edw.
Epicypta Winn.
immaculata Tonn.
dilatata Tonn.

A study of this list shows that, except for two species of *Sciara* which have probably been introduced from Europe, all the species are peculiar to New Zealand, and that 13 genera are endemic.

This Mycetophilid fauna is characterized by the comparatively large development of the Ditomyiinae; by the numerous endemic genera in the Sciophilinae (especially in the group Leiini) but all with very small number of species and by the extensive development of some genera in the Mycetophilinae, like *Mycetophila* and *Zygomyia*, the latter including double as many species as were hitherto described from the rest of the world.

There is no conspicuous gap in this fauna; only one small subfamily Lygistorhininae is not represented here, although it is found in Australia.

The large development of the Ditomyiinae shows Australian and South-American affinities, but for the rest the affinities with Australia are not particularly striking although there are a few genera, like *Pseudoplatyura* and *Aphelomera*, peculiar to both countries, or some New Zealand ones very closely related to Australian ones, like *Neotrizygia* to *Trizygia* and *Anomalomyia* to *Acodicrania*. Six endemic Australian genera are not represented in New Zealand. Among the genera of world-wide distribution found in Australia (inc. Tasmania) and in New Zealand, like *Macrocera, Zygomyia,* and *Mycetophila,* the number of species is considerably greater in the latter country.

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Howes, G. V. Hudson, S. Lindsay, D. Miller, A. Philpott, and J. T. Tapley.

We wish also to extend our sincere thanks to Professor Marshall for the loan of his valuable collection of types, and to Dr. W. Horn for the loan of the specimens of the Osten-Sacken collection at Berlin Dahlem.

Key to Sub-Families

1. Medio-cubital vein present, or these veins connected by a fusion or else apparently with a common base	2
Media and cubitus not connected by a cross-vein or fusion	6
2. R_4 present and rather long, generally half or more than half as long as R_5; Sc. short and ending free; posterior divisions of pronotum with one or more longish bristles	*Ditomyiinae*
R_4 less than half as long as R_5, sometimes weak or absent; Sc almost always long and ending distinctly in the costa; posterior division of the pronotum without long bristles	3
3. Media and radius fused for a short distance	4
Media and radius not fused, a distinct *r-m* cross vein present	5
4. Cu_1 and Cu_2 slightly approximated near the base, then divergent; anal angle of wing somewhat square; tibial bristle absent	*Macrocerinae*
Cu_1 and Cu_2 divergent from the base; anal angle of wing rounded; tibial bristles present even if small	*Ceroplatinae*
5. Cross-vein *m-cu* well before *r-m*, both vertical; media with distinct basal section and running straight as far as the fork	*Boletophilinae*
Cross-vein *m-cu* apparently absent, but Cu_1 separate from Cu_2 and arising from the stem of the media	*Diadocidiinae* part. (Heterotricha)
Cross vein *m-cu* and *r-m* both present and practically in one line; base of M wanting; Rs arising near the base of wing	*Diadocidiinae* part. (Diadocidia)
6. Eyes nearly or quite connected above antennae by a dorsal bridge; base of Rs short and transverse; *r-m* long and in a line with Rs	*Sciarinae*
Eyes rounded, without dorsal bridge; base of Rs and *r-m* both usually more or less oblique	8
7. Prothorax without strong bristles; head flat or slightly concave behind, with a row of projecting orbital bristles which are more or less curved backwards; antennae inserted much above the middle of the head	*Manotinae*
Prothorax with distinct long bristles; head convex behind; orbital bristles not forming a conspicuous projecting row; antennae inserted about the middle of the head	8
8. Microtrichia of wings irregularly arranged; Sc usually long; lateral ocelli usually far from the eye-margins	*Sciophilinae*
Microtrichia of wings in more or less definite lines; Sc short; lateral ocelli touching the eye-margins	*Mycetophilinae*

KEY TO GENERA.

Sub-family DITOMYIINAE.

Cross-veins *r-m* and *m-cu* present, the latter vertical joining Cu near the base; R_4 nearly parallel with R_5; M_{1+2} strongly curved near the base; M_3 straight anepisternites bristly; postnotum bare .... 1 *Centrocnemis* Phil.

Cross-vein *r-m* obliterated by partial fusion of Rs and M .... 2 *Nervijuncta* Marsh.

Sub-family DIADOCIDIINAE.

Only one New Zealand genus .... 3 *Heterotricha* Loew.

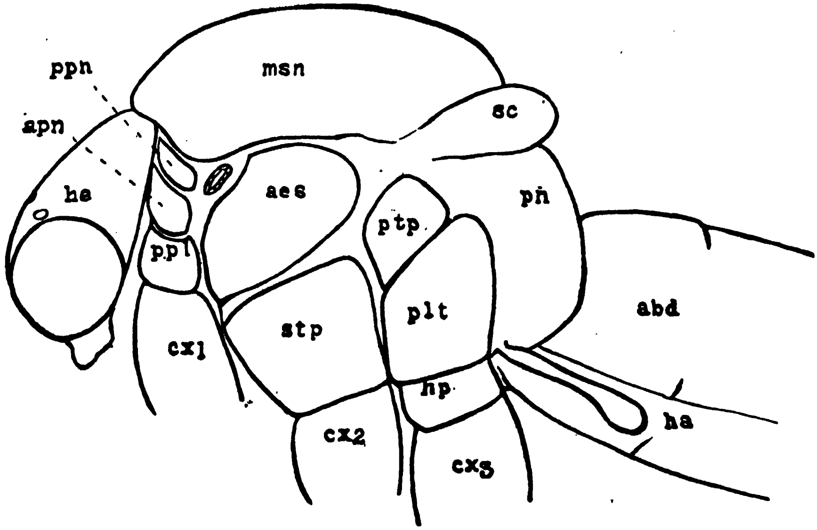

FIG. A. Thorax of a Fungus Gnat seen from the side. apn and ppn, anterior and posterior divisions of pronotum; ppl, propleura; stp, sternopleurite; aes, anepisternite; ptp, pteropleurite; hp, hypopleurite; plt, pleurotergite; pn, postnotum; sc, scutellum; msn, mesonotum; he, head; abd, abdomen; ha, halteres; cx_1, cx_2, cx_3, coxae.

Sub-family BOLITOPHILINAE.

Only one New Zealand genus .... 4 *Arachnocampa* Edw.

Sub-family MACROCERINAE.

– Head with longitudinal furrows; antennae about as long as the body, sometimes longer .... 5 *Macrocera* Mg.

– Head without longitudinal furrows; antennae about as long as the thorax, only the joints fusiform...... 6 *Paramacrocera* gen. nov.

Sub-family CEROPLATINAE.

1. Palpi reduced, with one visible segment; antennae stout and strongly compressed .... 7 *Cerotelion* Rond.

   Palpi normal with three or four distinct segments...... 2

2. Antennae strongly pectinate ..... *Platyroptilon Westw.
Antennae simple, with 15 segments ..... 8 *Pseudoplatyura* Skuse.
Antennae simple, with 16 segments ..... 9 *Platyura* Mg.

Sub-family SCIARINAE.

1. Palpi well developed; both sexes winged 2
Palpi reduced, with one or two small segments; female or both sexes sometimes wingless 3
2. Costa not produced over the tip of Rs, base of Rs placed on the last third of R_1 and consequently *r-m* very long ..... 12 *Ohakunea* gen. nov.
Costa produced over the tip of Rs; *r-m* moderately long ..... 10 *Sciara* Mg.
3. Both sexes winged; fork of Cu past the proximal end of *r-m* ..... 11 *Scythroprochroa* End.
Female wingless and halterless ..... 13 *Neophnyxia* gen. nov.

Sub-family MANOTINAE.

Only one New Zealand genus ..... 14 *Manota* Will.

Sub-family SCIOPHILINAE.

1. Two ocelli placed together; fine tibial setae arranged in regular longitudinal row; wings without macrotrichia on the membrane ..... *Mycomyiini*
Only one New Zealand genus ..... 15 *Mycomyia* Rond.
Three ocelli or when only two present the fine tibial setae are irregularly arranged 2
2. Wing with macrotrichia on the membrane; microtrichia sometimes absent. Postnotum usually with hairs or bristles; Sc nearly always long; last section of R_1 several times as long as *r-m*, which is oblique; 7th abdominal segment usually large and visible ..... 4 *Sciophilini*
Wings without macrotrichia on the membrane; 7th abdominal segment usually small and retracted..... 3
3. Sc always long; last section of R_1 several times as long as *r-m*, which is more or less oblique or vertical. Median fork always much longer than its stem ..... *Gnoristini*
Only one New Zealand genus ..... 23 *Synapha* Mg.
Sc long or short; last section of R_1 usually little if any longer than *r-m*, which is long and nearly horizontal ..... 11 *Leiini*.
4. Cubital fork always present and distinctly proximal to that of the media 5
Base of cubital fork distinctly distal to that of media or the cubital fork absent or incomplete 7
5. Postnotum hairy or bristly ..... 16 *Allocotocera* Mik.
Postnotum quite bare 6
6. Fork of Cu complete and short ..... 18 *Aneura* Marsh
Fork of Cu incomplete, Cu_1 being detached at the base; this fork always long ..... 17 *Taxicnemis* gen. nov.

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*This genus was mentioned by Osten-Sacken as being present in his small collection of New Zealand Diptera, but as it has never been found since, it is doubtful that it does really occur here; the specimen is not present in his collection preserved at the Berlin Museum.

7. Legs and body long and slender; first segment of front tarsi over twice as long as the tibiae, median fork broad, the branches curving widely at the base	20 *Phthinia* Winn.
Legs normal; median fork pointed at the base or absent	8
8. M_3 complete	9
M_3 absent or detached at the base and then present only as a short vein near the wing-margin. Cu_1 also faint and detached at the base or apparently absent	10
9. Cu simple; Sc_2 reaching R_1 before the base of Rs	19 *Parvicellula* Marsh
Cu branched; Cu_1 detached at base; Sc long; Sc_2 reaching R_1 well after the base of Rs	22 *Morganiella* gen. nov.
10. Sc ending in costa; base of M faint; Cu apparently unbranched	21 *Aphelomera* Skuse
Sc ending in R_1 past the base of Rs; M apparently unbranched; Cu_1 detached at base	22 *Neotrizygia* gen. nov.
11. Sc rather long, ending in costa	12
Sc short, ending free	13
12. Fork of Cu at a good distance from the base of the wing near that of M	25 *Anomalomyia* Hutt.
Fork of Cu at the base of the wing; Cu_2 sinuous	29 *Cawthronia* gen. nov.
13. M simple	14
M branched	15
14. Cu_2 sinuous; vein A ending in its elbow and forming thus a little basal cell or ending free at some distance before this elbow, the little cell not being then completely closed	27 *Cycloneura* Marsh
Cu_2 nearly straight, not forming a small cell with vein A; Cu_1 obsolete at base but if complete the fork of Cu would be placed a little before the origin of *r-m*	28 *Paracycloneura* gen. nov.
15. Vein M strongly sinuous; median fork much widened on its outer half; Cu_2 strongly sinuous and forming a little cell with vein A	30 *Sigmoleia* gen. nov.
Fork of M normal	
16. Fork of Cu near the base of the wing	26 *Paradoxa* Marsh
Fork of Cu under the stem of M	17
17. Pleurotergal bristles present	31 *Trichoterga* gen. nov.
Pleurotergal bristles absent	32 *Tetragoneura* Winn.

Sub-family MYCETOPHILINAE.

1. Anepisternal and pteropleural bristles absent; hind coxae with a fairly strong bristle at the base; empodia absent or rudmentary; hind tibial comb indefinite or absent	2
Anepisternal and pteropleural bristles present, hind coxae without basal bristle, empoda and hind tibial comb present	3
2. Base of cubital fork beyond that of M	34 *Exechia* Winn.
Fork of Cu below or before fork of M	33 *Allodia* Winn.

3. Cubitus unbranched	37 *Zygomyia* Winn.
Cubitus branched	4
4. Costa not or scarcely produced over the tip of Rs; Cu_1 slightly divergent from M_2 but parallel with or slightly convergent towards Cu_2	33 *Mycetophila* Mg.
Costa distinctly produced beyond the tip of Rs; Cu parallel with M_2 throughout but slightly divergent from Cu_2	36 *Epicypta* Winn.

1. Genus CENTROCNEMIS Phil.

This genus is characterized among the Ditomyinae by the presence of the cross vein *r-m* which is placed in a vertical line with the cross vein *m-cu*. It is found also in Chile, Tasmania and Victoria. The larva is boring in dead wood

The 5 New Zealand species can be distinguished as follow:

1. Base of abdominal segments yellow	3 *basalis* Tonn.
Base of abdominal segments brown or black	2
2. Head nearly completely brownish-grey; the dark stripes of the mesonotum fused (♂)	3
Head orange with a dark patch on the vertex; mesonotum with three distinct brown stripes or with its anterior part orange or else completely orange	4
3. Abdominal segments with a narrow yellow hind-border; hypopygium as in figs. 123, 125	1 *fumipennis* Tonn.
Abdomen practically all blackish; hypopygium as in figs. 124, 126	2 *tillyardi* Tonn.
4. Median ocellus subequal to the others; hypopygium as in figs. 131, 132	4 *nitida* Tonn.
Median ocellus much smaller than the others; hypopygium as in figs. 127, 128	5 *trivittata* Edw.

1. **Centrocnemis fumipennis** n.sp. Tonn. (Fig. 123.)

♂. Face, palpi, and the 4 first segments of antennae yellowish-orange, the rest of antennae brown, vertex grey. Disc of scutum brown, its lateral borders and scutellum yellow; postnotum and pleurae brown. *Abdomen* with the first segment grey, the others shining brown with a narrow yellow posterior border. Hypopygium with brown base and yellow lamellae, its structure complicated, according to fig. 123. *Legs* yellow with exception of the extreme base of posterior coxae and femora. *Wings* with their distal part from fRs smoky, more intensively so on the anterior border, costal cell yellowish; a small brownish spot at the origin of Rs and on *r-m;* origin of Rs at first third of wing, its petiole equal to its fork; fork of M a little before that of Rs; fork of Cu at the level of *r-m.* Halteres yellow.

Length of body, 6½ mm.; wing 6 mm.

Type: Otira (Tonnoir). 7th Nov., 1922, in Cawthron Inst. coll.

2. **Centrocnemis tillyardi** n.sp. Tonn. (Figs. 2, 124).

♂. Very similar to C. fumipennis; face and the two first segments of antennae dark, base of flagellum reddish and then gradually darker. Hypopygium different as shown in fig. 124. Fork of M a

little more proximal; distal part of wing nearly hyaline, distinctly brownish only along R_4.

The mesonotal bands are fused in the male but separate in the female.

Type: Mt. Arthur (Nelson), 24th Dec., 1921, in Cawthron Inst. coll.

Otira 10th Jan., 1920 (Campbell) 1 ♂, 1 ♀. Kinloch, L. Wakatipu, Jan., 1921 (Hudson).

3. **Centrocnemis basalis** n.sp. Tonn. (Figs. 1, 129, 130).

♂. *Head:* face, palpi and 4 to 5 first segments of antennae yellow; vertex yellow with grey ocellar triangle. *Thorax:* scutum brownish-red, pleurae lighter. *Abdomen:* the two first segments rather narrowly yellow at their base, the following ones more so and the two last completely dark. Hypopygium yellow, its dorsal lamellae ending in a small tooth; see fig. 130. *Legs* yellow. *Wings:* tip and posterior border slightly smoky, chiefly along the veins; venation similar to preceding species but the fork of M at the same level as the fork of Rs, petiole of M and its second branch weak; a brown spot at the base of Rs, on *r-m* and fCu; another large one on fRs and extending on fM. Halteres yellow.

Length of body: 6 mm.; wing: 6 mm.

Type: Waiho (Tonnoir), 20th Jan., 1922, in Cawthron Inst. coll. Raetihi Hill 3,000 ft. (Harris) 1 ♂. West coast S.I. (Harris) 1 ♀.

4. **Centrocnemis nitida** n.sp. Tonn. (Figs. 3, 131, 132.)

♂. Similar to *C. fumipennis* but head orange with a dark ocellar triangle; mesonotum yellowish-red anteriorly, with three more-or-less-fused stripes posteriorly; abdomen very shining above, coloration as in *fumipennis* but venter yellow. Tergum of hypopygium dark, the rest yellow or reddish. Wings without the apical dark area, its structure according to figs. 131, 132.

♀. General coloration lighter than in the male the mesonotal stripes being only faintly indicated or absent.

Length of body 5·5 mm., wing 5·5 mm.

Type: Dun Mountain (Nelson), 5th Jan., 1922 (Tonnoir), in Cawthron Inst. coll. Allotype: Aniseed Valley (Nelson), 1st Dec., 1923 (Tonnoir). Paratypes: Nelson, Sept., Oct., Nov., Dec.

Otira 10th Jan, 1910 1 ♂ 1 ♀ (Campbell). Ohakune 20th Nov., 1919 (Harris) 1 ♀.

5. **Centrocnemis trivittata** n.sp. Edw. (Figs. 127, 128).

♂. Very similar to *C. nitida,* but the median ocellus is much smaller than the lateral ones; the mesonotal stripes are almost as distinct and as black in the females as in the males and the hypopygium is differently constructed, the claspers being considerably longer and relatively narrower and the ventral spine-like appendages much longer. See figs. 127, 128.

Type: Governors Bay (J. F. Tapley), Sept., 1922, in British Museum coll. White Rock (Campbell) paratypes; 1 ♂ 1 ♀ 26-28 Nov., 1922. Deans Bush, Riccarton (Tonnoir), 17th March, 1925, and 8th Jan., 1925. Christchurch (Tonnoir), 18th Feb., 1925. Cass (Tonnoir), 27th Nov., 1924.

2. Genus NERVIJUNCTA Marsh.

Marshall, *Trans N.Z. Inst.*, vol. 28, p. 265.

Synonymy: *Huttonia* Marsh.; *Cyrtoneura* Marsh.; *Cycloneura* Hutton; *Casa* Hutton.

This genus peculiar to New Zealand comprises a good number of forms which are very interesting on account of the sexual dimorphism occurring in a certain number of species, the males of which exhibit a broad truncate wing of peculiar shape; even among the males of a given species there is sometimes a similar dimorphism, some larger and stouter individuals having the anterior portion of the wing rather incrassate whereas others are similar to the females. The large species are mostly found on the tree trunks.

Key to Species.

1. Tip of M_1 strong and dark, contrasting with the fainter basal portion (*Arctoneura*)	2	
Tip of M_1 scarcely if any darker than the basal portion; small species, wing not much over 5 mm. (*Nervijuncta* s. str.)	13	
2. Anterior pronotal lobes largely dark brown above; face ochreous to dark brown, without distinct silvery dusting, but with rather long and numerous bristly hairs	3	
Anterior pronotal lobes entirely pale yellow; face conspicuously silvery when viewed from above, with a few rather short hairs arranged in a transverse row	8	
3. R_4 normally crossing the clear space and ending well beyond tip of R_1; middle pair of mesonotal stripes several times narrowly interrupted but almost reaching the front margin	4	
R_4 not crossing the clear space, and ending only a short distance beyond tip of R_1; mesonotum normally with a broad transverse yellow band in front; flagellum ringed	5	
4. Flagellum all black, wings with two broad blackish bands	1	*hudsoni* Marshall
Flagellum ringed; wings more mottled	2	*wakefieldi* Edw.
5. A large dark mark on lower part of sternopleura; wings with a brown patch below An, covered with macrotrichia	4	*tridens* Hutton.
No dark patch on sternopleura; no macrotrichia in anal field except just below tip of Cu_2	6	
6. Eye-bridges only three facets wide and separated in the middle by about the width of six facets; mesonotum typically with two dark spots near front margin in middle	5	*ruficeps* Edw.
Eye-bridges at least four facets wide and separated in the middle by at most the width of three facets; mesonotum with a narrow but continuous dark band near front margin	7	
7. Mouth parts entirely pale yellowish	6	*parvicauda* Edw.
Labium and last segment of palpi blackish	7	*pilicornis* Edw.
8. Wings yellow with suffused markings; mesonotum all yellow on anterior third; pleurae all yellow......	8	*flavescutellata* Tonn.

Wings less yellow, markings distinct; mesonotum with a narrow blackish band close behind the front margin; pleurotergites with a large dark patch — 9

9. Wings cuneiform at base, the anal field narrow; subapical clear band almost devoid of macrotrichia — 9 *longicauda* Edw.

Wings not cuneiform, anal field rather broad; macrotrichia evenly distributed over apical half of wing — 10

10. Anepisternites entirely black; no dark patch on sternopleurite — 11 *harrisi* Edw.

Anepisternites with a blackish patch below, and another one at the upper corner or its upper part only darkish — 11

11. Flagellum more or less distinctly ringed; scutellum usually with six equally strong bristles; R_4 completely traversing the clear space; dark wing-tip including distinct hyaline areas — 10 *hexachaeta* Edw

Flagellum all black; scutellum usually with only four strong bristles, sometimes an additional weaker pair; R_4 only just entering the clear space; wing-tip almost all dark — 12

12. Sternopleurite all yellow; anal field largely covered with macrotrichia — 12 *nigricornis* Tonn.

Sternopleurite blackish below; anal field devoid of macrotrichia except in the small dark area below tip of Cu_2 — 13 *osten-sackeni* Tonn.

13. Front margin of mesonotum broadly yellow; upper half of pleurae yellow, the lower half black, strongly contrasting with the yellow coxae — 14 *nigrescens* Marsh.

Colour of thorax quite otherwise — 14

14. Scutum entirely orange; eye-bridges much widened in the middle — 18 *bicolor* Edw.

Scutum yellowish with three dark stripes, the lateral pair curved sharply down in front and continued across the pleurae; eye-bridges less widened in the middle, if at all — 15

15. Wings largely dark; costa and hind margin with three yellowish areas, apart from the base — 15 *pulchella* Edw.

Costa and hind margin with only one or two yellowish areas separated from the pale base — 16

16. Palpi yellow; R_4 crossing the clear space — 16 *marshalli* Edw.

Palpi black; R_4 ending at beginning of clear space — 17

17. Anal field nearly bare; posterior coxae yellowish — 16 *punctata* Tonn.

Anal field hairy; hind coxae black at least at base — 19 *nigricoxa* Edw.

1. Nervijuncta hudsoni (Marsh). (Figs. 11, 148.)

Marshall, *Trans. N.Z. Inst.*, vol. 28, 1896, p. 263 (Cyrtoneura).

The wings of this species are not scaly; the type had only some lepidopterous scales adhering to it..

Hypopygium large, claspers of simple structure, long broad and leaf-like without appendages. (Fig. 148.)

Type: Wellington (Hudson).

1 ♂ Waimarino (Hudson), 4th Jan., 1922; 2 ♂ ♂ Ohakune (Harris), 15th Dec., 1922 and 15th Jan., 1923; Taumaranui (Harris) Nov., 1924.

All specmiens taken on tree trunks.

There is a considerable variation in size, the wing-length going from 9 to 14 mm.; R_5 is also more or less curved and the first abdominal segment may be all black or with a basal clear band.

2. **Nervijuncta wakefieldi** Edw. (Figs. 12, 140-142.)
Edwards, *Ann. Mag. Nat. Hist.* (*g*) 7, 1921, p. 435.

Type in Oxford Museum without locality but probably from Canterbury, Stewarts Gully (Christchurch) 30th Sept., 1917; Governors Bay (Tapley), 21st Aug., and 30th Nov., 1922; Ohakune (Harris) Nov.-Dec., 1922; Auckland (coll. Hutton); Nelson, Sept.-Dec., 1912; Deans Bush (Christchurch) 8th Jan., 1925; Cass, 27th Nov., 1924 (Tonnoir).

This species varies greatly in size, which ranges from 6 to 12 mm. (wing-length); also in the shape and the intensity of the markings of the wings. In the larger specimens the wings are truncate at the tip and their anterior border is curving out whereas the anal field is much reduced; the veins R_1 and R_4 are very thick and fused together so that their tips form a kind of stigma, the base of R_4 is hooked; the dark markings are the same all through but they are much more intensive in the larger specimens and the clear spaces in the dark apical facia in cell R_4 and R_5 are yellowish. There is little difference in the structure of the hypopygium of the larger and the smaller forms the indentation of the ventral edge of the claspers being only more shallow in the large specimens (compare figs. 140 and 141.)

In the female the shape of the wings and the venation is the same as in the small males.

3. **Nervijuncta wakefieldi** var. **abbreviata** n.

Differs from typical *N. wakefieldi* as follows:—

The fine bristles of the mesonotum less numerous, and blackish in colour instead of ochreous. Middle mesonotal stripe not distinctly divided posteriorly. Two strong propleural bristles. R_4 shorter, ending immediately beyond tip of R_1 and almost at beginning of the clear space, costa thickened at tip of R_4 as is frequently the case in males but seldom in females of this group of species.

Type ♀ : Queenstown (L. Curtis); Feb., 1924.

4. **Nervijuncta tridens** (Hutt.) (Figs. 19, 145.)

Hutton, Cat. N.Z. Diptera 1881, p. 12 (Platyura). Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 268. (Huttonia). Hutton, Ind. Faun. N.Z. 1904. (Casa).

The type of Hutton which was taken in Wellington is now in Marshall's collection in the Cawthron Institute. The abdomen is missing, but the species is easily recognizable on account of the brown patch covered with macrotrichiae below A. Hypopygium as shown in fig. 145.

Ohakune (Harris), Dec., 1922, Nov., 1923; Riccarton (Gourlay). Nelson, 16th March, 1923; 8th Sept., 1923; 16th Oct., 1923; Kaikoura, 11th Feb., 1922. Christchurch, 18th Feb., 1922 (Tonnoir).

5. **Nervijuncta ruficeps** n.sp. Edw. (Figs. 10, 137, 138.)

♂. *Head* reddish-ochreous, small black spots round ocelli and on nape. Face and mouth-parts entirely yellowish, face with slight

greyish dusting. Eyes with usually small dorsal bridges which are only three facets wide near their origin and taper to points, these points being separated by a distance equal to the width of about six or eight facets. Antennae with first segment ochreous, second brown; flagellum short-haired, first four or five segments ochreous with black subapical rings, the rest black. *Thorax* with yellowish ground-colour. Anterior division of pronotum with continuous black dorsal band. Scutum with three separate dark brown stripes, lateral pair continued across scutellum, middle one divided longitudinally by a yellow line and broadly interrupted in front, reappearing close to front margin as two separate blackish spots. Postonotum blackish except at sides; pleurotergites blackish except in front. Hypopleurite and sternopleurite all yellow. Anepisternite blackish in front, colour continued downwards across front coxae. Scutellum with four strong bristles. *Abdomen* yellow, tergites with broad black basal bands. Hypopygium moderately large; dorsal projections rather long and finger-like; claspers broad and leaf-like, with slightly emarginate apically, with a long slender, pubescent appendage which is usually turned cephalad (figs. 137, 138). *Legs* ochreous; front and hind coxae, and under side of hind femora brownish; tibial spurs black. *Wings* with a rather strong yellowish tinge, somewhat cuneiform, the anal field narrow. Macrotrichia absent from basal half, and also from large yellow area near base of R_5. Dark markings on the usual plan and rather sharply defined, but reduced in size, especially the patch over the middle of R_5. R_4 ending in the large black patch close to the tip of R_1; R_5 moderately arched. Halteres ochreous, knob somewhat darkened except at tip.

Length of body, 6.5 mm.; wing, 7 mm.

Type ♂: Ohakune (T. R. Harris); paratypes 4 ♂; Nov.-Jan.

Var. *continua* nov. Resembles the type in most respects, particularly in structure of the hypopygium, but differs as follows:—

Eye-bridge not quite so widely separated. Dark mark on pronotum divided into two spots, but median stripe of scutum without distinct central yellow line, and uninterrupted in front, where it widens out to reach posterior pronotal lobes. R_4 thicker; R_5 more strongly arched.

Length of body, 8 mm.; wing, 8·5 mm.

Type ♂: Karaka Grove, Sincliar Head (G. V. Hudson); 14th Nov., 1923, in Brit. Mus coll.

The narrow eye-bridges and widely-separated eyes are diagnostic of this species.

6. **Nervijuncta parvicauda** n.sp. Edw. (Fig. 153.)

♂ *Head* brownish-ochreous, black round ocelli. Face yellowish, with a heavy dusting, but not conspicuously silvery. Mouth-parts entirely yellowish. Eye-bridges four facets wide, separated in middle by about the width of two facets. Antennae with first segment ochreous, second darker; flagellum with short bristles, pubescence nearly as long as diameter of segments; first 6-8 segments ochreous with black subapical rings, the rest entirely black. *Thorax* with yellowish ground-colour. Pronotum with a complete blackish band. Scutum with three dark stripes which adhere in front, where they are broadly interrupted; lateral pair extending over scutellum;

median stripe not distinctly divided longitudinally; a narrow transverse blackish band close to front margin of scutum. Postnotum dark-brown in middle, more broadly so towards base; pleurotergites blackish, except in front; sternopleurite and hypopleurite all yellow; anepisternite blackish on anterior half or more, no black spot behind it below wing-root. Scutellum with four strong bristles, and an additional outer weaker pair. *Abdomen* yellow, tergites with broad black basal bands. Hypopygium small; dorsal projections shortly club-shaped; claspers short, not half as long as hypopygium, with two groups of black spiny bristles on inner side at base. *Legs* ochreous, tibiae and tarsi darkened, also mid and hind femora on upper side about middle; spurs black. *Wings* with slightly yellow ground-colour and with strong dark markings of the pattern usually in this group; Tip mainly dark, but including large hyaline areas in cells R_4, R_5 and M_1, which, however, leave the margin dark. Anal field moderately broad without dark patch. Macrotrichia absent from basal half of wing, but evenly spread over the apical half except for a very small area in the clear space near the base of R_5. R_4 ending in the dark patch close to tip of R_1; R_5 gently arched. Halteres ochreous.

♀ Differs from the ♂ as follows:—

Black rings of antennal segments broader and placed nearer base; vertical hairs much longer, nearly twice as long as segments; pubescence shorter. Front coxae darkened. Anal lamellae ochreous. Wing-markings rather stronger. Base of knob of halteres dark.

Length of body, ♂ 5·5, ♀ 6·5 mm.; wing ♂ 6·5, ♀ 7·5 mm.

Type ♂ : Ohakune (T. R. Harris), allotype, paratypes 3 ♂, Dec., 1922 and Jan., 1924, in Brit. Mus. coll.

Wellington (Hudson) in coll. Hutton as *Casa tridens.*

var. *suffusa* nov.

♀ Differs from the type in having a conspicuously dark cloud along the hind margin of the wing below An, this cloudy area however not bearing any macrotrichia; hind femora dark below as well as above.

Length of body, 5 mm; wing, 5·5 mm.

Type: Ohakune (T. R. Harris), Jan., 1924.

7. **Nervijuncta pilicornis** n.sp. Edw.

♀ Rather closely resembles *N. parvicauda,* differing as follows:—

Size rather larger. Eyes a trifle more widely separated, the distance between the bridges in the middle being equal to the width of three facets. Face without distinct grey dusting. Verticillate hairs of flagellum longer, some of them distinctly over twice as long as segments. Mouth-parts darker, the last palpal segment black, labium blackish. *Thorax* similarly marked, but postnotum with a yellow triangle at the base; anepisternite brownish only on lower third and in upper anterior corner, a small black dot behind it below wing-root. Femora hardly darkened. Hyaline areas in wing-tip larger, the apical margin hardly darkened; a larger bare area in the clear space near base of R_5.

Length of body, 7½ mm.; wing, 9 mm.

Type: Ohakune (T. R. Harris), paratype 1 ♀, 15th Dec., 1922 and 15th Jan., 1923, in Brit. Mus. coll.

8. **Nervijuncta flavoscutellata** n.sp. Tonn. (Figs. 14, 15, 134.)

♂ *Head* dark orange above, black around the ocelli; face silvery epistome and mouth-part yellow; eye-bridges rather narrow, 4-5 facets wide, not touching; antennae: scape dark orange, flagellum brown. *Thorax* completely yellowish-orange with exception of posterior part of scutellum with three confluent dark stripes, the middle stopping before reaching scutellum, but the lateral ones extending on its sides; postnotum also brownish. *Abdomen* with basal part of segments dark in the middle, the rest orange; hypopygium orange with roundish claspers carrying black spines on their proximal internal edge. (Fig. 134.) *Legs* yellowish, darker towards extremity. *Wings* with a very distinct yellowish tinge, the dark markings rather washed out, the macrotrichia rather well distributed on distal half of the wing according to figs. 14, 15. Haltères yellow.

Length of body 5½ mm.; wing 6 mm.

Type: Mt. Arthur (Tonnoir), 27th Dec., 1922, in Cawthron Inst. coll.

Paratypes: Dun. Mt. (Philpott), 9th Dec., 1920; Nelson, 9th Dec., 1920; Ohakune, Raetihi Hill, 3000 ft., Nov., 1923; Mt. Ruapehu, 4500 ft. (Harris), Feb., 1924.

9. **Nervijuncta longicauda** n.sp. Edw. (Figs. 16, 139.)

♂ *Head* black above, appearing slightly dusted with grey when viewed from behind. Face yellowish, heavily covered with silvery pollinosity. Mouth-parts ochreous. Eye-bridges almost in contact and about seven facets wide. Antennae with scape ochreous, second segment darker apically; flagellum short-haired, first five or six segments ochreous with black subapical rings, the rest all black. *Thorax* with yellowish ground-colour. Pronotum entirely pale yellow. Scutum with a blackish band across front margin, followed by a broad ochreous band, behind which are the usual three dark stripes, confluent in front, separate behind; lateral pair darkened posteriorly and not quite reaching scutellum; this, however, is broadly blackish round apical margin. Postnotum with a large double brown mark which does not reach sides or base. Pleurotergites black posteriorly; sternopleurite blackish below. Anepisternite yellow in middle, dark brown on lower and upper thirds, a small black dot behind it below wing-base. Scutellum with four strong bristles, and one or two weaker ones. *Abdomen* ochreous, tergites with broad blackish basal bands. Hypopygium extremely elongate; dorsal projection filiform, about twice as long as basal part; claspers almost three times as long as basal part, elongate boot-shaped, basal part slender, ochreous, apical part blackened with a comb-like ridge on inner face and three spiny bristles at heel (fig. 139). *Legs* ochreous, tibiae and tarsi darkened, spurs black; fore and hind coxae largely brownish, mid and hind femora brownish beneath near base. *Wings* with hyaline ground, more yellowish in cell R_4, cuneiform at base, anal field narrow. Macrotrichia absent from basal half, and also from subapical clear band. Markings as figured; R_4 greatly thickened, as is costa and tip of R_1 where R_4 meets these veins; R_5 strongly arched. Halteres ochreous, knob somewhat darkened.

Length of body, 10 mm.; hypopygium alone 2 mm.; wing, 9 mm.

Type: Wilton's Bush, Wellington (G. V. Hudson), Nov., 1921, in Brit. Mus. coll. Raetihi Hill, Ohakune, 3000 ft. (T. R. Harris) paratype ♂, Nov., 1923; Waitaki Oct., 1894, in coll. Hutton as *Arctoneura hudsoni;* Flora River (Nelson) 4th Nov., 1923; Mt. Arthur Jan., 1923 (Philpott), 8th Jan., 1925 (Hudson).

10. **Nervijuncta hexachaeta** n.sp. Edw. (Figs. 18, 143.)

Much resembles *N. longicauda* in colouration, differing chiefly as follows:—

Anepisternite less extensively dark above. Sternopleurite either entirely yellow or with only a small dark area below. Scutellum usually with six equally strong bristles, but these apparently not quite constant. Hypopygium much shorter and smaller, dorsal projections hardly as long as basal portion, claspers broad but with comb-like ridge on inner face somewhat as in *N. longicauda* (fig. 143). Coxae all ochreous. *Wings* with the macrotrichia evenly spread over outer half, and in most specimens fairly numerous also in anal field, which is markedly broader than in *N. longicauda,* No yellow tinge in cell R_4; vein R_4 not thickened and running right across the clear area. R_5 only gently arched.

Length of body, 6-7 mm.; wing, 6-7 mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll; paratypes 5 ♂ 2 ♀ Weraroa (D. Miller); 1 ♂ Wilton's Bush, Wellington (G. V. Hudson); 1 ♂ Otira (A. L. Tonnoir); 1 ♀ West Coast of South Island (T. R. Harris); 1 ♂ Glenorchy (C. C. Fenwick); 1 ♂ Nelson (Gourlay) 23rd Nov., 1923; 26th Dec., 1923; Aniseed Val. Dec., 1923; Dun Mt. Jan., 1922; Otira 9th Nov., 1922; Kaitouna 6th Feb., 1922 (Tonn.).

This species seems widely distributed, and is subject to some variation, especially in the scutellar bristles and the amount of hairiness in the anal field. It may eventually be possible to distinguish definite local forms.

11. **Nervijuncta harrisi** n.sp. Edw. (Figs. 146, 147.)

Head velvet-black above, face also with dark integument, but clothed with brilliant silvery pollinosity. Mouth-parts yellowish. Eye-bridges almost in contact and about five facets wide. Antennae almost entirely blackish, only first three or four flagellar segments showing ochreous rings, more distinct in ♀ than in ♂, verticils short. *Thorax* somewhat as in *N. longicauda,* but the three scutal stripes fade into orange anteriorly and are not entirely obsolete in the yellow area; dark patch on postnotum reaches base; sternopleurite all yellow; anepisternite almost entirely velvet-black, only a small area on posterior margin being yellow; no black dot below wing-root. Scutellum with four bristles. *Abdomen* ochreous, first segment entirely so, following segments with backish basal bands. Anal lamallae of ♀ yellow. Hypopygium rather small. Ochreous, claspers blackish; dorsal projections short, claspers rather longer than basal portion, of rather irregular shape, without strong spines (fig. 147). *Legs* ochreous, tibiae, tarsi and most of hind femora darkened. *Wings* with hyaline ground colour, and dark markings arranged much as in allied species. Anal field rather broad, without dark patch, but with

fairly numerous macrotrichia, which are also evenly distributed over apical half of wing. Tip including extensive hyaline areas. R_4 ending just beyond dark area in ♂, beyond middle of clear area in ♀; R_5 gently arched. Knob of halteres somewhat darkened.

Length of body, 5 mm.; wing, ♂ 5 ♀ 6 mm.

Type: Ohakune (T. R. Harris), Feb., 1924, in Brit. Mus. coll.; allotype ♀ Nov., 1923; paratype, Feb., 1921.

The almost wholly black anepisternite will readily distinguish this species from all its near allies.

12. **Nervijuncta nigricornis** n.sp. Tonn. (Fig. 9.)

♀ *Head*: Vertex and occiput dull black, face silvery, mouth-parts yellowish. Antennae brownish-black; eye-bridges 6 facets wide, nearly touching. *Thorax:* pronotum yellow; mesonotum with an anterior transverse brown band, its disc brown but the bands not distinct from each other; space before and disc of scutellum yellow; four scutellar bristles, (on one side an additional small one); postnotum and posterior part of hypotergite dark, the rest of pleurae yellow. *Abdomen*: segments black with a rather wide posterior yellow border, base of first segment also yellow as well as superior terminal lamellae. *Legs* yellowish, tibiae gradually and the tarsi darker. *Wings* with strong dark markings; macrotrichia evenly distributed in distal part of wing, nearly all anal field also with macrotrichia; the clear transverse zig-zag band in distal dark fascia uninterrupted; faint clear spot in apical dark fascia in cell R_5 and M_1. Halteres yellowish, base of knob darkish.

Length of body 7 mm., wing 7½ mm.

Type: Days Bay (Tonnoir) 29th Nov., 1921, in Cawthron Inst. coll.; Ohakune (Harris).

13. **Nervijuncta Osten-Sackeni** n.sp. Tonn. (Figs. 4, 133.)

♂ *Head* dark brown above, face silvery, epistome and mouth-parts yellowish; eye-bridges at least six facets wide, contiguous; antennae with first segment yellow, second somewhat darker, flagellum dark. *Thorax*: pronotum yellow, mesonotum with an anterior brownish border and three longitudinal bands starting at a good distance from anterior border, these bands confluent in middle, the middle one not reaching scutellum but the lateral ones extending on its sides; postnotum darkened, pleurotergites and sternopleurites darkish below, anepisternites brown below and on the upper corner, scutellum with four long bristles and two very small ones. *Abdomen* with first segment yellow, the following one dark with yellow posterior border. Hypopygium dark with exception of anal lamellae; claspers spoon-shaped with two internal crossed basal spines (fig. 133). *Legs* ochreous, tarsi darker. *Wings*: macrotrichia evenly distributed on the apical half, a small patch along the base of R_5; markings as shown in fig. 4.

Length of body 5 mm., wing 5½ mm.

Type: Otira (Tonnoir) 10th Feb., 1922, in Cawthron Inst. coll. numerous ♂ ♂ Ohakune (Harris); 1 ♀ West Coast South Is. (Harris).

14. **Nervijuncta nigrescens** Marsh. (Figs. 21, 136.)

Marshall, *Trans. N.Z. Inst.*, vol. 28, 1896, p. 266, pl. 8, fig. 1.

The locality of the type is not recorded; this species has been found again in Mt. Arthur Dec., 1921; Reefton 13th Jan., 1922; Waiho 30th Jan., 1922; Wellington 1st Dec., 1921; Lake Brunner 4th Nov., 1922; Okarahia 5th Nov., 1925.

15. **Nervijuncta pulchella** n.sp. Edw. (Fig. 17.)

♀ *Head* brownish-ochreous, black round ocelli, but between ocelli and eyes heavly dusted with yellowish-grey. Face ochreous above, shading to dark brown below. Eye-bridges about three facets wide at their origin; widening to about six facets wide in middle, where they are in contact. Mouthparts black, labium very short. Antennae with scape orange, flagellum black. *Thorax* with pale yellow ground-colour dorsally, pronotum and shoulders almost white. Scutum with three orange-brown stripes, the lateral pair strongly curved down in front, with both ends much darkened, giving an appearance of four dark brown spots on the scutum; median stripe widened anteriorly and reaching front margin, narrowed and somewhat darkened posteriorly. Scutellum blackish, with only two strong bristles. Postnotum dark brown in middle, especially towards base. Pleurae largely ochreous, but with blackish stripe extending from behind prothoracic spiracle to lower part of pleurotergite; hypopleurite white. *Abdomen* dark brown; posterior margins of tergites narrowly and of sternites more broadly ochreous; anal lamellae ochreous. *Legs* ochreous, only tarsi darkened; spurs black. *Wings* mainly blackish, pale at base and with three zig-zag yellowish bands which tend to be interrupted in middle, leaving yellow triangles on costa and hind margin. R_4 moderately long, ending just before the outermost yellow band; R_5 nearly straight; *r-m* fusion short. Halteres brownish.

Length of body, 3 mm.; wing 3·7 mm.

Type: West Coast, Greymouth (?) (T. R. Harris), Feb., 1923. Ohakune (T. R. Harris); paratype ♀, April, 1923.

Although the smallest, this is perhaps also the most distinctively marked of the genus. The type is unfortunately badly damaged.

16. **Nervijuncta punctata** n.sp. Tonn. (Figs. 7, 135.)

♂ *Head* orange, black round ocelli, face orange, mouth-parts dark; eye-bridges moderately wide and contiguous; antennae: scape orange, flagellum brown. *Thorax*: pronotum dark above, mesonotum with three dark bands, the median one wedge shaped and stopping much before scutellum, lateral bands much curved anteriorly and connected with dark line on pleurae; middle of postnotum and posterior part of hypopleurites brown. *Abdomen* with first segment yellowish, others brown with posterior border yellow; venter and side pieces of hypopygium yellowish. Hypopygium with claspers claw-shaped and with an internal blade-like expansion (fig. 135). *Legs* yellowish, tibiae and tarsi darker. *Wing*: macrotrichia evenly distributed on distal three-fifths of membrane, this part of wing being brown except for transverse clear zig-zag band with its middle angle pointing inward; another dark patch on base of Rs and in anal field; base of Rs much curved forward, R_4 extending in clear space but not crossing it

completely and reaching costa at a certain distance from tip of R_1. Halteres completely yellowish.

♀ Similar to male, end lamellae yellow, transverse distal clear band of wing broken into spots.

Length of body 3½ mm., wing 4 mm.

Type: Mt. Arthur (Tonnoir) 21st Dec., 1921, in Cawthron Inst. coll. Allotype: *idem* 28th Dec., 1921; Paratypes: Lake Brunner 5th Feb., 1922; Otira 10th Feb., 1922; Nelson Dec., 1923; Hilltop (Cant.) Jan., 1925 (Tonnoir).

16a. **Nervijuncta punctata** var. **robusta** Tonn.

Some specimens of larger size show a venation somewhat different; anterior veins much thicker, chiefly R_4 which joins costa at tip of R_1 from there on for a certain distance the costa is rather thick; the clear fascia is either complete or divided into spots and the membrane is there partly bare. The hypopygium is apparently not different from the one of the typical form but the claspers are shorter and stronger.

Length of body 4¾ mm., wing 5½ mm.

Type: Mt. Arthur (Tonnoir) 25th Dec., 1921, in Cawthron Inst. coll. Allotype *idem* 20th Dec., 1921; paratopotype, 24th Dec., 1921.

17. **Nervijuncta marshalli** n.sp. Edw. (Fig. 6.)

♀ *Head* dark brown above, dusted over with yellowish-grey, which is most conspicuous round eye-margins. Face light ochreous. Eye-bridges of about even width, four or five facets wide, in contact in the middle. Palpi light yellow, labium rather darker, very short. Antennae with scape orange, flagellum black. *Thorax* with the pronotum dark brown; scutum light yellowish with three dark brown stripes, middle one reaching front margin and indistinctly divided by a yellow line, lateral pair strongly curved down in front. Scutellum dark brown, with two strong bristles and two very short ones. Pleurae mostly dark, but with some greyish mottling; postnotum and pleurotergites wholly dark brown and somewhat shining. *Abdomen* black; tergites 5 and 6 orange except in middle line; sternites 5-7 whitish; anal lamellae black. *Legs* rather dark ochreous, all coxae, also tarsi and spurs blackish. *Wings* with conspicuous dark brown markings as shown in figure; subapical pale band narrow, its middle part displaced distally so that it is almost divided into three spots. Macrotrichia evenly spread over apical half of wing. R_4 moderately long, ending in dark tip; R_5 gently cuved; *r-m* fusion rather short. Halteres ochreous, base of knob darkened.

Length of body, 4 mm.; wing, 4½ mm.

♂ Differs from female by coloration of abdomen which is completely dark including hypopygium; halteres completely orange and front coxae lighter than the posterior ones.

Type: Ohakune (T. R. Harris); Mar., 1923, in Brit. Mus. coll. Also 1 ♀ in Prof. P. Marshall's collection, without data; this latter differs from the type in having mesonotal stripes mainly orange, only centres dark brown.

Allotype: Aniseed Valley (Tonnoir) 1st to 4th Dec., 1923 with other ♂ ♂ and ♀ ♀; 1 ♂ Ohakune 9th Mar., 1923 (Tonnoir); Goose Bay (Kaikoura) 4th Feb., 1925.

Although with some slight resemblance to *N. punctata* Tonn. this species is really very distinct in wing-markings and venation, as well as in its yellow palpi and dark coxae.

18. **Nervijuncta bicolor** n.sp. Edw. (Figs. 20, 151.)

Head dark brown above, face light ochreous. Eye-bridges only three or four facets wide near their junction with main portion of eyes, but widening out towards middle where they are eight or nine facets wide and broadly in contact. Mouth-parts black, the labium very short. Antennae with the scape ochreous, flagellum blackish except base of first segment. *Thorax* almost uniformly bright ochreous-brown, only scutellum darker, this bearing only two strong bristles. Pleurae also somewhat darkened in some specimens. *Abdomen* rather dark brown, base of second segment and basal part of hypopygium more ochreous; in ♀ abdomen is lighter than in ♂, especially on segments 4-6, but last segment and anal lamellae are black. Male claspers long, broadest near base and tapering to a dark cloud over base of Rs, a brownish band just beyond middle, point. *Legs* ochreous; tarsi darkened; spurs black. *Wings* with a dark cloud over base of Rs, a brownish band just beyond the middle, which is narrower over base of median fork, and the whole tip broadly brownish. Macrotrichia evenly distributed over apical half. R_4 long reaching well into dark tip of wing and ending far beyond tip of R_1. R_5 only slightly arched; *r-m* fusion short. Halteres dark brown.

Length of body, 3½-5 mm.; wing, 4½ mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes 4 ♂ 6 ♀, Nov.-Jan.

The form of the eyes will readily distinguish this species from all others at present known, except perhaps *N. pulchella.*

19. **Nervijuncta nigricoxa** n. sp. Edw. (Figs. 149, 150.)

♂ *Head* as in *N. pulchella,* except that eye-bridges are uniformly about four facets wide. *Thorax* much as in *N. pulchella,* but darkened areas of scutal stripes less definite and apparently variable in extent; scutellum yellow in middle, with four strong marginal bristles; pleurae and postnotum much more extensively dark, but hypopleurite remaining pale. *Abdomen* with first segment almost all yellow; following segments black with the hind-borders conspicuously yellow; hypopygium ochreous with large black claspers of somewhat complicated structure (figs. 149, 150). Anal lamellae of ♀ yellow, genital parts black. *Legs* ochreous, the hind-coxae except sometimes towards tip, base of mid-coxae of hind femora and tibial spurs black. *Wings* faintly yellowish with light brown tip and more or less interrupted light brown fascia just beyond middle. Macrotrichia extending over outer two-thirds or thereabouts, and over large part of anal field. R_4 rather short, ending in dark area; R_5 gently curved; *r-m* fusion short. Halteres ochreous.

Length of body, 3½-4½ mm.; wing 4½ mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes 2 ♀, Dec., 1922-Jan., 1923; also 1 ♀, Mar., 1924.

Although somewhat resembling *N. punctata* Tonn., this species is evidently quite distinct through the dark hind coxae, the less extensive dark markings of the wings, the more numerous macrotrichia, and especially by the structure of the hypopygium.

3. Genus HETEROTRICHA Loew.

The form which is here referred to Loew's rather inperfectly known fossil genus, differs from it, as far as venation is concerned, by R_1 ending well after the level of the fork of M and not before, and by *r-m* being rather short. On the other hand it comes nearer to *Paleoheterotricha* Meun. (which is very likely identical with *Heterotricha*) by the long R_1 and short *r-m;* its venation differs, however, in the New Zealand form from that of a South African species described by Edwards (1), by the longer Sc and the curved Rs.

This genus has been referred to the Sciarinae and the Mycetophilinae respectively by Meunier and Enderlein; Edwards in the above-mentioned paper thinks that it comes closer to the Sciarinae on account of the shape of the eyes of the South African species; however, the New Zealand one with its bridgeless eyes does not allow this view to be sustained any longer.

We think it is best to place it with the *Diadocidiinae,* if we consider that the section of the vein between *r-m* and Cu_1 is in reality *m-cu* and that the base of M is missing as in *Diadocidia.* However, the real status of this genus remains uncertain; its peculiar distribution is of great interest; it is known so far from the Baltic amber and South Africa, besides New Zealand.

Heterotricha novae-zealandiae n.sp. Tonn. (Fig. 231.)

♂ *Head*: Eyes slightly hairy, oval, somewhat emarginate near base of antennae, no traces of bridge, distance betwen them on frons being equal to distance between the two outer ocelli. The three ocelli nearly in a line, outer ones far removed from eye-margins, median one smaller. Antennae dark brown, first and second flagellar segment yellowish; first flagellar segment about six times as long as wide, their length gradually diminishing towards extremity; whole antennae as long as abdomen which is twice length of head plus thorax. Palpi rather long, yellowish, composed of three distinct segments, the first two subequal to each other and about 4-5 times as long as wide, the last one longer and thinner. The whole head blackish-grey. *Thorax:* Mesonotum shining black with yellowish hairs arranged in three stripes on disc leaving bare spaces between them; some bristles present on pronotal lobes and tuft of small hairs on hypopleurites; pleurotergites flat and bare. *Abdomen* shining black with rather long and dense golden pubescence; seventh segment visible; hypopygium black with two slender ribbon-like elongate whitish processes; it's structure as in fig. 231. *Legs* slender and rather elongate; tibiae with a few very small bristles; spurs normal; apical comb on front tibiae present; empodium absent, pulvilli present but very small, half as long as claws. Coxae and femora yellowish, trochanter, tip of post-femora and tibiae and tarsi brownish. *Wings* subhyaline;

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(1) Ann. South Afric. Museum 19, 1925, p. 605.

micro and macrotrichia present on whole membrane. Sc long ending free after base of Rs; R_1 rather long ending well after fork of M; Rs unbranched, much curved and parallel to costa on its distal part; costa extending much after tip of Rs; *r-m* short, shorter than basal section of Rs; fork of M subequal to its stem; base of M apparently missing; *m-cu* very oblilquely placed so as to appear the base of M issuing from Cu_1; fork of Cu near the wing-base; A distinct on its basal half only. Halteres yellow.

Length of body and wing 3½ mm.

Type: Aniseed Valley, Nelson (Tonn.) in Cawthron Inst. coll.

4. Genus ARACHNOCAMPA Edw.

Edwards, *Ann Mag Nat. Hist* (9) vol. 14, 1924, p. 177.

This genus common to New Zealand and Tasmania seems to be rightly referred to the subfamily Bolitophilinae, the imago differing from *Boliotophila* only by a few characters such as the absence of empodia and pulvilli, by the base of Rs placed much nearer the wing base, etc.; however, the larva is completely different from that of *Bolitophila* and can scarcely be distinguished from the larva of *Ceroplatus.*

Arachnocampa luminosa (Skuse). (Figs. 23, 154.)

Skuse, *Tans. N.Z. Inst* 23, 1891, p. 48 (*Bolitophila*).

Only the female was known to Skuse; the male differs but little; the abdomen is still more slender and the anterior part of its segments from the second on is distinctly marked with yellow, this pale colouring extending also more or less along the middle of the tergites. Hypopygium brown, its structure simple as shown in fig. 154.

Length of body 9 mm., wing 5 mm.

Allotype: Nelson, Dun Mt. Dec., 1923 (A. Phipott), in Cawthron Inst coll.

Although the larva of this species is very common in some parts of New Zealand, especially in some caves, the fly is exceedingly rare; only a few specimens are known to be in different collections; they come from Wellington, Waitomo, and Nelson.

5. Genus MACROCERA Mg.

This genus of nearly world-wide distribution is particularly well represented in New Zealand.

Key to Species.

1.	Macrotrichia present on at least the outer half of the wing	2.
	Wing-membrane devoid of macrotrichia	8.
2.	R_4 absent; middle coxae blackish, the front and hind pairs ochreous	3.
	R_4 present	5.
3.	Wing-tip dark, without included pale markings	1. *scoparia* Marshall
	Dark wing-tip including three pale marks, in the cells R_5, M_1 and M_2	4.
4.	Pale marks in the dark wing-tip somewhat crescent-shaped; antennae ringed	2. *milligani* Tonn.
	Pale marks round; antennae not ringed	3. *fenestrata* Edw.

5.	A dark pleural stripe extending over mid coxae as in the above three species; wings without dark spot at tip	6.
	Pleurae and coxae all ochreous; wing-tip dark	7.
6.	A dark spot in middle of wing; antennae ringed	4. *unipunctata* Tonn.
	Wings unmarked; antennae not ringed	5. *campbelli* Edw.
7.	Wing-markings strong; spot in cell Cu_1 united with a dark patch running from the costa	6. *antennalis* Marsh.
	Wing-markings rather faint; spots in cell Cu_1 separate	7. *obsoleta* Edw.
8.	Wing conspicuously banded	9.
	Wing quite unmarked	10.
9.	Antennae more or less ringed; mesonotum with dark stripes	8. *hudsoni* Tonn.
	Antennae all black; mesonotum entirely shining reddish	9. *ngaireae* Edw.
10.	Abdomen all black; wings somewhat smoky; Sc ending above base of Rs	11.
	Abdomen with basal pale band on several segments	13.
	Abdominal segments with apical pale bands	12.
11.	Base of antennae ochreous; mesonotum brown; knob of halteres yellowish, its stem whitish basally blackish apically	12. *fusca* Tonn.
	Base of antennae dark; mesonotum orange; stem of halteres yellowish, the knob blackish	13. *gourlayi* Tonn.
12.	Sc ending above base of Rs; small slender species	14. *annulata* Tonn.
	Sc ending above the tip of the basal cell; larger and more robust species	15. *inconspicua* Tonn.
13.	Pleurae and the four posterior coxae all black; first abdominal segment all yellow	14.
	At least the hind coxae yellowish; first abdominal segment dark apically	15.
14.	Sc very short and ending free; A very faint, hardly distinguishable except at base	10. *pulchra* Tonn.
	Sc ending in costa above base of Rs; A fairly distinct	11. *ruficollis* Edw.
15.	Antennae completely dark	17. *glabrata* Tonn.
	First joints of the flagellum yellow with their extreme tip dark	16. *montana* Marsh.

1. **Macrocera scoparia** Marsh. (Fig. 26.)
Marshall *Trans N.Z. Inst.*, 28, 1896, p. 272, pl. 9, fig. 1.

This species is the most common of the genus; it can be easily distinguished by the characters as given in the key.

Wellington (Hudson); Ohakune (Harris); Christchurch (Campbell); Governors Bay (Tapley); Dunedin (Watt); Queenstown and Stewart Is., (Curtis); Te Aroha; Nelson; Otira; Cass; Akaroa; Kaikoura; Waiho (Tonnoir) from Sept. to March.

2. **Macrocera milligani** n.sp. Tonn. (Fig. 31.)

♂ *Head* orange, the vertex brownish, palpi brown; antennae about half as long again as body, first two joints orange, those of the flagellum dark brown with base conspicuously yellow on basal joints 5-6, the rest practically completely brown. *Thorax* orange with dark vertical stripe on pleurae extending on middle coxae. *Abdomen* with

first segment orange. posterior margin of segment 2 and 3 brown; the following segments brown, sometimes base of 7th orange; hypopygium dark. *Legs* orange-yellow, posterior femora and tibae brownish, all tarsi also infuscated. *Wings* hairy on their whole surface and with two groups of markings, one on basal half composed of a spot at base of Rs, one at tip of R_1, a larger one at the parting of Rs and M and a less conspicuous one at bend of Cu_2; the second group of markings is formed by tip of wing being extensively infuscated, this dark area including three pale crescent-shaped spots placed proximally in cells Rs, M_1 and M_2. The vein R_4 is missing. Halteres with yellow base and knob dark orange.

♀ Similar to male, antennae as long, abdomen lighter, posterior margin of segment being narrowly infuscated.

Length of body and wing 4 mm.

Type: Christchurch (Tonnoir) 17th Feb., 1922, in Cawthron Inst. coll.

Allotype: Nelson (Tonnoir) 28 Sept., 1923.

Paratypes: Khandallah; Nehotapu; Otira; Lake Brenner; Nelson (Tonnoir).

Other specimens in Brit. Mus.; Ohakune (Harris); Purau (Campbell); Governors Bay (Tapley); Queenstown (Curtis); Alexandra (Fenwick).

3. **Macrocera fenestrata** n.sp. Edw. (Fig. 30.)

Very near *M. milligani* Tonn., differing as follows:—

♀ Size smaller. Antennae flagellum almost all black, with only faint traces of pale rings at joints. Mesonotum with three brownish stripes. Pleurotergites mainly blackish. Abdomen more extensively dark, pale bands interrupted in middle. *Wings* with a narrow but almost complete band across middle ending on hind-margin below tip of Cu_2; three round pale spots included in the extensively darkened tip.

♂ similar to female, abdomen yellowish at base only, completely dark from fourth segment.

Length of body, 2·8 mm.; wing, 3·2 mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll., April, 1923.

Allotype: Wairakei (Tonnoir), 6th Mar., 1923; Lake Brunner, 20th Dec., 1925 (Tonn.).

4. **Macrocera unipunctata** n.sp. Tonn. (Fig. 29.)

♂ *Head* orange, frons, vertex, and palpi dark; antennae longer than body, scape orange, the five first segments of flagellum orange with their apical $\frac{2}{3}$ brown, following segments brown with base very narrowly and indistinctly orange. *Thorax* orange, pleurae with vertical brown line extending on middle coxae; middle of postnotum and posterior part of hypotergites brown. *Abdomen* orange, second to the last visible segment brown at base. Hypopygium orange. *Legs* yellowish-orange, darker on tarsi. *Wings* hairy mostly on distal part but also quite densely on anal field, a few rather brownish spots in middle of wing; one at base of Rs, one rather elongate below extremity of R_1 and on parting of Rs and M, tip of wing very slightly infuscated. Sc as long as basal cell, R_4 present and ending a little way past tip of R_1. Halteres yellowish-orange.

♀ Similar to male but the brown colouration a little more extensive: first segments of the flagellum are more brown than yellow and also abdominal segments.

Length of body and wing, 4½ mm.

Type: Auckland, coll. Hutton, in Canterbury Museum.

Allotype: *idem.*

Paratypes from the same locality and from Lake Brenner (Tonnoir) 5th Feb., 1922.

Specimens in Brit. Mus.: Ohakune (Harris); 1 ♀, third and fourth flagellar segments subequal in length; Clifton (Harris); 1 ♂ Christchurch (Campbell); 8 ♂ 2 ♀ fourth flagellar segment in ♂ as long as first three together; in ♀ only 1·6 times as long as third.

5. **Macrocera campbelli** n. sp. Edw.

♂ *Head* blackish above, face ochreous. Palpi black. Antennae entirely black except for ochreous scape and outer half of the first flagellar segment; second flagellar sgement only a little shorter than first, third and fourth slightly longer than second. *Thorax* ochreous; mesonotum with traces of three darker stripes; pleurae with dark brown vertical stripe extending over middle coxae. *Abdomen* ochreous, with broad blackish hands towards bases of first four tergites, that on tergite 2 the broadest; segments 6 and 7 almost wholly black. Hypopygium small, brownish, claspers of usual form. *Legs* ochreous, tarsi darkened. *Wings* devoid of markings; macrotrichia numerous on apical half. Tip of R_1 much swollen, the actual tip pale but preceded by a darkened area. R_4 very short and nearly transverse. Base of M rather strong and dark. Halteres with ochreous stem and dark brown knob.

Length of body, 4 mm.; wing, 4½ mm.; antennae probably about 7-8 mm. (tips broken).

Type: Mt. Grey (J. W. Campbell), 23rd Feb., 1924, in Brit. Mus. coll.

This is very nearly allied to the Australian *M. mastersi* Skuse.

6. **Macrocera antennalis** Marsh.

Marshall, *Trans N.Z. Inst.*, 1894, p. 271.

The male only of this beautiful species was described by Prof. Marshall. Female differs only slightly from male by the shorter antennae and the wings more hairy, the macrotrichia extending in the anal field; the abdominal segments are brown with an orange posterior margin.

Type in Cawthron Institute.

Allotype in Canterbury Museum, Lake Brenner (Tonnoir) 5th Feb., 1922.

Other specimens in Brit. Mus.: Ohakune and Mt. Ruapehu (Harris); West Coast S.I. (Harris); Blackball and Mt. Grey (Campbell); Pokororo (Philpott); Cass; Nelson (Tonnoir) from Dec. to Feb.

7. **Macrocera obsoleta** n.sp. Edw.

Very near *M. antennalis* Marshall, differing as follows:—

Size rather smaller. Dark abdominal bands less conspicuous. *Wing*-markings much fainter; central mark either absent (as in type), or (as in other three specimens examined) passing straight down-

wards over base of median fork, instead of obliquely over stem of fork, and therefore separate from dark mark in cell Cu_1. R_2 rather longer and more oblique.

Length of body, 4-5 mm.; wing, 4.5-6 mm.; ♂ anetnnae, 11-14 mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratype ♂, Nov., 1923, Jan., 1924; West Coast of South Island; Greymouth; (?), (T. R. Harris); paratypes 1 ♂ 1 ♀, Feb., 1923. Aniseed Valley, 1st Dec., 1923 (Tonnoir).

8. **Macrocera hudsoni** n.sp. Tonn. (Fig. 28.)

♂ *Head* and palpi orange, antennae somewhat longer than body, scape orange, distal third of first flagellar joint brown, the 2-3 following joints with base narrowly orange the rest brown. *Thorax* orange with a few brownish markings on pleurae and mesosternum. *Abdomen* dark orange, base of segments rather extensively brownish except on sides, the last visible segment completely dark. *Legs* orange-yellow with extreme tip of posterior femora and tibiae dark. *Wings* without macrotrichiae, two conspicuous dark bands: a median transverse one from tip of R_1 to tip of A., apical band contains three roundish clear spots on edge of wing and placed respectively in cells; R_5, M_1, and M_2. Halteres orange.

♀ Similar to male but abdomen more extensively brown.

Length of body 6 mm., wing 6½ mm.

Type: Aniseed Valley (Nelson) 1st to 4th Dec., 1923 (Tonnoir). Allotype: *idem.*

Paratypes: Waiho, Jan., 1922; Maitai Valley (Nelson), Dec., 1922; Cass, Nov., 1924 (Tonnoir).

Specimens in Brit. Mus.: Ohakune; West Coast South Island (Harris); Wilton's Bush, Wellington, 1 ♂ 1 ♀ (Hudson).

9. **Macrocera ngaireae** n.sp. (Fig. 27.)

Nearly allied to *M. hudsoni* Tonn., and resembling that species in its wing-markings and venation and in having antennae of male very little longer than those of female, but differing as follows:—

Head brighter in colour and with hardly any grey dusting above; face and palpi wholly reddish-orange. Antenal flagellum entirely black, without trace of pale rings. *Thorax* more shining, bristles shorter and less conspicuous; dorsum wholly reddish-orange, pleurae, however, almost entirely blackish. *Abdomen* quite unbanded, though darkened towards tip, genitala of both sexes, however, being orange. *Legs* brighter orange, but hind coxae with a more distinct black mark at base outwardly; tibial spurs orange. *Wings* with middle and subapical bands connected in cell R_1.

Type ♂: Karioi (T. R. Harris), Oct.-Nov., 1923; Mt. Ruapehu, 4,500 ft. (T R. Harris), allotype ♀, Feb., 1924.

This very fine species is named in commemoration of the birth of Miss Ngaire Beth Harris, daughter of the collector.

10. **Macrocera pulchra** n. sp. Tonn. (Fig. 24.)

♂ *Head* palpi and scape of antennae brown, flagellum yellow; antennae at least twice as long as body. *Thorax* brown. *Abdomen* with two first segments and base of third yellow, the rest of the abdo-

men brown. *Legs* yellow, coxae dark. *Wings* with slight yellowish tinge, veins light; Sc apparently incomplete. Halteres yellow.

♀ Antennae somewhat shorter; mesonotum orange; only two first abdominal segments yellow.

Type: Lake Brunner (Tonnoir) 4th Feb., 1922, in Cawthron Inst. coll.

Allotype: *idem*, 5th Feb., 1922.

Paratopotypes: 2 ♂, 2 ♀; Ohakune (Harris) 1 ♂, Mar., 1923.

11. **Macrocera ruficollis** n.sp. Edw.

♂ Resembles *M. pulchra* Tonn., but evidently quite distinct on account of the following differences:—Size larger. Only the first three or four flagellar segments yellowish, the rest dark. Mesonotum rather bright reddish-ochreous in front, dark brownish posteriorly. Second abdominal tergite with a black apical band, third to fifth each with narrow but complete yellow basal bands. Front coxae entirely clear yellow. *Wings* with the anal angle much more square (and therefore more normal). Sc distinct and ending in costa above base of Rs. Stem of median fork quite distinct, not almost obliterated as in *M. pulchra*. An. fairly distinct throughout.

Length of body, 4½ mm. wing, 4 mm.; antennae broken.

Type: Ohakune (T. R. Harris), Nov., 1922.

12. **Macrocera fusca** n.sp. Tonn.

♂ Completely brown species with exception of mesonotum which is somewhat reddish and also second and base of third antennal segments; base of stem of halteres whitish, its distal half black and knob yellowish. *Wing* bare uniformly smoky; Sc very short, its tip in front of the origin of Rs.

Length of body: 3 mm., wing, 3¾ mm., antennae 5 mm.

Type: Ohakune (Tonnoir) 8th Mar., 1923, in Cawthron Inst. coll.

13. **Macrocera gourlayi** n.sp. Tonn.

♂ Very similar to *M. fusca* from which it differs by the antennae completely brown, mesonotum and scutellum orange, front coxae and femora yellowish as well as hypopleurites. Halteres with yellowish stem and dark brown knob. Front legs with first tarsal joint equal to half of tibiae (in fusca equal to $\frac{7}{10}$). *Wing* venation and colouration the same.

Same size.

Type: Nelson (Gourlay) 24th Nov., 1923, in Cawthron Inst. coll.

Paratopotype: 1 ♂ in Canterbury Museum.

14. **Macrocera annulata** n.sp. Tonn.

♂ *Head* orange, vertex brown, palpi dark; antennae distinctly longer than body, yellow at base and gradually darker towards extremity. *Thorax:* mesonotum dark orange with two wide lateral brown stripes united in front by beginning of median dark stripe; rest of the thorax brown. *Abdomen* brown, posterior border of segments 2 to 6 yellow; hypopygium brown. *Legs* brownish yellow more infuscated towards extremity, front coxae yellowish, posterior ones

brown. *Wing* bare with a slight brownish suffusion, veins dark, venation as in preceding two species. Halteres completely pale yellow.

Length of body and wing 3½ mm.

♀ similar to male.

Type: Waiho (Tonnoir) 21st Jan., 1922.

Allotype: *idem* 16th Jan., 1922.

Paratypes: Otira 9th Feb., 1923; Nelson, ,8th Dec., 1921; Waiho, 16th, 30th Jan., 1922 (Tonnoir).

15. **Macrocera inconspicua** n.sp. Tonn.

♀ *Head* orange, vertex brown, palpi dark; antennae as long as body, the 3-4 first joints orange, the rest gradually darker brown. *Thorax* ground-colour orange with brown markings; mesonotum with three dark stripes, median one little marked; scutellum brown, disc of postnotum and pleurotergites, mesopleurae and mesosternum brown. *Abdomen* mostly dark with posterior border of segments orange; lamellae orange. *Legs* yellowish orange gradually darker on tarsi. *Wings* very slightly infuscated and with tiny brownish streak below dital part of R_1; Sc exactly as long as basal cell; tip of R_1 nearly reaching level of fRs; R_4 rather long. Halteres orange.

Length of body and wing 5 mm.

Type: Neotupu (Tonnoir) 23rd Feb., 1923, in Cawthron Inst. coll.

Paratype: Lake Brunner (Tonnoir) 4th Feb., 1922.

16. **Macrocera montana** Marsh. (Fig. 25.)

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 270.

A comparison of the types of this species and of *M. howletti* Marsh. shows that they belong to the same species: this last one must therefore be considered as a synomym of *M. montana.*

M. montana is characterized chiefly by its antennae, the flagellum being completely orange but for a very narrow dark ring at tip of segments which are however darker towards extremity of antennae. Vestiture of the first segments of flagellum is composed of very small black bristles on dorsum of segment whereas sides and ventral part are covered with whitish downy hairs; vestiture of last segments is practically all dark.

The two specimens in Prof. Marshall's collection are females; one male exhibiting the above-mentioned characteristic features of the antennae can be considered as the allotype of the species and differs from the female as follow:

Scape not brown but orange, somewhat lighter than basal segments of flagellum. Pleurae somewhat darker than mesonotum but not brown, the postnotum completely orange. Abdominal segments mostly orange with the posterior border brown. *Legs* yellowish darker on tarsi.

Length of body and wing 4 mm.

Allotype: Ohakune (Tonnoir) 8th Mar., 1923.

17. **Macrocera glabrata** n.sp. Tonn.

♂ *Head* brownish orange, palpi brown; antennae as long as body, entirely dark. *Thorax* darkish orange pleurae somewhat darker in middle, this infuscation extending on middle coxae. *Abdomen* mostly

brown with base of five first segments yellowish-orange. *Leg* yellowish, tarsi darker. *Wings* hyaline without spots or macrotrichiae; Sc shorter than basal cell; R_1 rather long nearly reaching the level of fork of Rs. Halteres with yellow stem and dark knob.

Length of body and wing 4 mm.

Type: Otira (Tonnoir) 9th Feb., 1922, in Cawthron Inst. coll.

This species comes very near the preceding one but is rather darker, the antennae palpi and abdomen being mostly black and also the middle coxae.

6. PARAMACROCERA n. gen.

This new genus is proposed for a peculiar little species which differs from *Macrocera* as follows:—

Head apparently without the longitudinal furrows seen in all species of *Macrocera*. Antennae quite short, the flagellar segments rounded, almost moniliform. Palpi very short, the segments not longer than broad. Hind coxae as long as the middle pair. Wings with macrotrichia over practically the entire surface; Cu_1 and Cu_2 less distinctly approximate near the base;; An faint apically.

The genus must be referred to the Macrocerinae rather than the Ceroplatinae on account of the presence of long and distant anepisternal hairs; of a distinct front tibial comb, though this is not quite so well marked as in *Macrocera;* and of small pulvilli and empodium, though again these are less distinct and hairy than in *Macrocera;* also on account of the entire absence of definite bristles on the tibiae. Further, the presence of macrotrichia on the wings is a character at present unknown in the *Ceroplatinae.*

Genotype, *P. brevicornis* n. sp.

Paramacrocera brevicornis n.sp. Edw. (Fig. 32).

♂ *Head* blackish above, face and palpi ochreous. Antennae about as long as head and thorax together, scape brownish, flagellar black; flagellar segments only about as long as broad, somewhat rounded, with short but distinguishable necks, pubescence about half as long as diameter of segments, each segment also with one or two longish dorsal hairs. *Thorax* brownish-ochreous, prothorax, middle of pleurae and hypopleurite lighter. Mesonotal bristles long though not very stout; dorsocentral in a double row, acrostichal in a single medium row, scutellum with two long bristles and a few short hairs. *Abdomen* dark brown, first tergite and posterior margins of segments 2-5 ochreous; segments 6-7 and hypopygium blackish; claspers exactly as in typical species of *Macrocera,* with two sharp terminal teeth. *Legs* ochreous, tibiae and tarsi darkened (hind tibiae and tarsi missing). *Wings* quite unmarked, macrotrichia occurring over practically the entire surface; venation as figured: Sc ending opposite origin of Rs; R_4 oblique and arising before tip of R_1, which is not at all thickened, costa extending over a third of the distance from R_5 to M_1. Halteres ochreous, base of knob darker.

Length of body, 2½ mm.; wing, 2·3 mm.

Type: West Coast of South Is., Greymouth (?) (T. R. Harris), Feb., 1923, in Brit. Mus. coll.; Nelson (Tonnoir) 21st and 28th Nov., 3 ♂.

7. Genus CEROTELION Rond.

This genus is probably cosmopolitan but not yet known from the Ethiopian region. It includes the N.Z. species which were formerly referred to *Ceroplatus*.

Key to Species.

1. Wings completely clear and body completely black	4. *vitripennis* Tonn.
Wings with more or less intensive markings	2.
2. Halteres yellow; wing-markings dark and rather sharply defined, the central spot filling the base of cell M_1	1. *leucoceras* Marsh.
Halteres whitish, knob dark except at tip	2. *dendyi* Marsh.
Halteres with the knob completely black	3.
3. Hind femora blackish at each end, with a broad whitish median ring	3. *hudsoni* Marsh.
Hind femora dark at base only or inconspicuously so at the tip	4.
4. Thorax mainly black; male claspers with three apical large teeth only	7. *niger* Tonn.
Mesonotum with three separate dark stripes; male claspers with several small teeth on inner margin	5.
5. At least the last antennal segment yellow	5. *bimaculatus* Tonn.
Antennae all black	6. *tapleyi* Edw.

1. Cerotelion leucoceras (Marsh.) (Fig. 158.)
Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 276, pl. 13, fig. 3 (Ceroplatus).

The colouration of this species is rather variable, the mesothoracic dark stripes being sometimes confluent; the abdomen also is more or less orange and the legs more or less extensively black. The male has one or two terminal antennal segments yellow; the female has the basal part of the flagellum entirely dark.

Type from Wanganui coll. Marshall; Ohakune (Harris); West Coast of South Is. (Harris); Governors Bay (Tapley); Nelson (Tonnoir), from Nov. to March.

2. Cerotelion dendyi (Marsh.)
Marshall, *Trans N.Z. Inst.*, 28, 1896, p. 275, pl. 9, fig. 3.

This species has not been found again; the two specimens in the Prof. Marshall collection had been obtained from Alford Forest (Canterbury).

3. Cerotelion hudsoni (Marsh.) (Fig. 34.)
Marshall, l.c. p. 276 (Ceroplatus)

The type came from the vicinity of Wellington but it is now lost.

One male has been found again by Mr. Harris in Ohakune, 1st March, 1919; the wings of this specimen are largely smoky.

4. Cerotelion vitripennis n.sp. Tonn.

♂ *Head* black, palpi yellow; antennae dark, two first joints slightly lighter below. *Thorax* and *abdomen* dull black with black pubescence; venter slightly rufous. *Legs* orange-yellow, coxae infuscated towards tip, base of posterior femora dark. *Wings* entirely clear.

Halteres with yellowish stem and dark knob. Hypopygium: claspers with two large terminal teeth and an internal series of irregular smaller teeth; side-hooks nearly as in *C. niger*.

Length of body, 5 mm., wing, 4 mm.

Type: Cass (Tonnoir) 1st Dec., 1924, in Canterbury Museum.

Paratopotypes: 2 ♂♂.

5. **Cerotelion bimaculatus** n.sp. Tonn. (Figs. 33, 155, 156.)

♂ *Head* ochreous, darker on the vertex, face and mouth-parts yellow; antennae brown, segment 5 to 7 dark orange, last one yellowish-white. *Thorax:* mesonotum and scutellum dark orange, the former with three brown separate bands; pleurae dark with exception of greater part of hypotergite anteriorly. *Abdomen* orange with a posterior dark band on segments. *Legs:* coxae orange with tip black, base of femora blackish, their distal part and tibiae orange, tarsi darker. *Wings:* tip of Sc after origin of Rs, A not quite reaching posterior border; brown patches well marked, proximal one not extended in cell M_1 but extending up to costa, distal one starting from tip of R_4. Halteres with yellowish stem and black knob.

Length of body: 4 mm., wings 3½ mm.

Type: Nelson (Tonnoir) 4th Mar., 1922, in Cawthron Inst. coll.

Paratype: Lake Brunner (Tonnoir) 2nd Feb., 1922; Ohakune (Harris) 6 ♂ 1 ♀.

The female differs from the male in having only the last antennal segment yellow.

6. **Cerotelion tapleyi** n.sp. Edw.

Rather closely resembles *C. bimaculatus* and has an identical venation and structure of the hypopygium, but differs as follows:—

Antennae entirely black in both sexes. Hind femora less extensively black at base. Central wing-spot rather smaller, barely touching base of cell M_1.

Type ♂ : Governors Bay (J. F. Tapley), in Brit. Mus. coll.

Paratypes 3 ♂ 1 ♀ : Sumner (Campbell) 1 ♂ ; Dunedin (C. C. Fenwick) 1 ♀.

7. **Cerotelion niger** n. sp. Tonn. (Fig. 157.)

♂ Nearly completely dull black, *abdomen* more or less shining. Palpi and lower part of face yellowish. Posterior coxae and base of femora dark, the rest of the *legs* dark yellowish. Venation as in *C. bimaculatus*, the markings much fainter, the central one not quite reaching costa. Halteres with black knob and yellowish stem.

Length of body: 4½ mm., wing 3½ mm.

Type: Queenstown (Curtis), 15th Dec., 1919, in Cawthron Inst. coll.

8. Genus PSEUDOPLATYURA Skuse.

Known only from Australia and New Zealand.

Pseudoplatyura truncata n.sp. Tonn.

A dark brown species with yellow halteres.

♂ *Head* with appendages completely dark brown; antennae scarcely longer than head, segments of flagellum difficult to make out. *Thorax:* mesonotum brown with three darker bands where the rows

of hairs are situated. *Abdomen* uniformly brown also hypopygium which is very small. *Legs* brown, tibiae and tarsi lighter. *Wings* uniformly smoky; Sc short, evanescent, not reaching costa nor base of Rs; R_4 rather oblique, its tip at a good distance from R_1. All the longitudinal veins reaching costa. Halteres yellow, rather long.

Length of body 2½ mm.,, wing 3 mm.

Type: Lake Brunner (Tonnoir) 3rd Feb., 1922, in Cawthron Inst. coll.

Paratype: *idem.*

9. Genus PLATYURA Mg.

The genus Platyura had been recently restricted by the junior author to species with a more or less bristly postnotum; however since then some connecting forms between this genus so restricted and *Isoneuromyia* have been studied which show that until more material of this group is known a division of the old genus *Platyura* would be premature, however heterogenous it may seem. The first two species of this list although provided with bristles on the postnotum are in fact more closely related to *Isoneuromyia* by the rest of their morphology.

Platyura is a cosmopolitan genus.

Key to Species.

1.	Postnotum with a transverse row of longish bristles posteriorly; vein An abbreviated; costa reaching about four-fifths of the distance from R_5 to M_1, its terminal section more than half as long as R_5	2.
	Postnotum bare; costa reaching at most half-way from R_5 to M_1, its terminal section not a quarter as long as R_5	3.
2.	Antennae entirely dark; abdomen orange, hind border of middle segments dark; hypopygium as in fig. 160	1. *brevis* Tonn.
	Base of antennae orange; abdomen as dark as the mesonotum; hypopygium as in fig. 159	2. *subbrevis* Tonn.
3.	Vein. A. more or less abbreviated; mesonotum uniformly covered with fine bristles; a row of fine bristles immediately behind the prothoracic spiracles; male abdomen compressed apically, clasper small and hidden	4.
	A. reaching the margin; mesonotum with more or less conspicuous bare lines between the acrostichal and dorsocentral series of bristles; no spiracular bristles; male abdomen somewhat depressed, ninth tergite small, claspers large and of simple structure with two terminal teeth somewhat as in *Macrocera*	8.
4.	Wings dark with a whitish transversal line	3. *albovittata* Tonn.
	Wings hyaline	5.
5.	Palpi yellow	6.
	Palpi blackish	7.
6.	Male ninth tergite short	7. *brookesi* Edw.
	Male ninth tergite produced and bilobed	6. *proxima* Tonn.
7.	Abdomen all dark	4. *marshalli* nom. nov.
	Abdominal tergites pale apically	5. *lamellata* Tonn.

8.	Costa scarcely reaching beyond the tip of R_5	9.
	Costa longer	10.
9.	Thorax largely orange in both sexes	8. *novae-zelandiae* nom. nov.
	Thorax nearly all black in male	9. *harrisi* Tonn.
10.	Wings with conspicuous markings; R_4 nearly half as long as R_5	12. *maculipennis* Tonn.
	Wings unmarked or at most with a slight dark cloud at the tip; R_4 much shorter	11.
11.	Wings with a strong yellow tinge, tip slightly darkened; abdomen red (female)	12.
	Wing not strongly yellow, tip not darkened	13.
12.	Thorax slate grey	10. *philpotti* Tonn.
	Mesonotum reddish	11. *rutila* Edw.
13.	Fusion of R and M punctiform; first segment of front tarsi much shorter than the tibae	13. *punctifusa* Edw.
	Fusion of R and M long and distinct; first front tarsal segment little if any shorter than the tibiae	14.
14.	Wings brownish	14. *carbonaria* Tonn.
	Wings hyaline	15.
15.	Abdomen entirely shining black	15. *chiltoni* Tonn.
	Abdomen with yellowish ochreous markings	16.
16.	Abdominal segment 1-4 (♂) or 1-7 (♀) practically all ochreous, 5-7 in ♂ all black; base of R_4 generally well beyond tip of R_1; ninth tergite of male narrowed to the tip	17.
	Abdominal segments 2-4 with dark basal band or all dark (♂) or with lateral spots (♀); base of R_4 usually below tip of R_1; ninth tergite of male broad and rounded apically	18.
17.	Antennae longer; knob of halteres brownish; R_5 rather curved at end; costa stopping at the first third of the distance between the tip of R_5 and M_1	16. *campbelli* Tonn.
	Antennae shorter; halteres all yellow; R_4 rather straight; costa reaching the middle of the distance between the tips of R_4 and M	17. *ruficauda* Tonn.
18.	Hypopleurite blackish or dark brown (♂ ♀); prothorax, first abdominal segment and usually hind coxae blackish in ♂; halteres yellow	18. *agricola* Marsh.
	Hypopleurites ochreous; first abdominal segment and hind coxae yellowish in male	19.
19.	Prothorax dark; side pieces of hypopygium with short bristles only	19. *curtisi* Edw.
	Prothorax yellow; side pieces of hypopygium with three long bristles on the inner side, two median dorsal and one apical ventral......	20.
20.	Mesonotum usually with three dark stripes; only the last segment of the antennae distinctly longer than broad	20. *rufipectus* Tonn.
	Mesonotum almost all ochreous; last 6-8 antennal segments each distinctly longer than broad	21. *ohakunensis* Edw.

1. Platyura brevis n.sp. Tonn. (Fig. 160.)

♂ *Head* with appendages dark. *Thorax* orange, mesonotum more reddish with bare lines between acrostichal and dosocentral series of bristles. *Abdomen* with five first segments orange with dark posterior border, last two visible segments dark. Hypopygium dark, structure according to fig. 160; claspers thick at base and suddenly thin in their last half. *Legs* yellowish-orange, darker on tarsi. *Wings* quite clear; Sc short not quite reaching level of base of Rs. Base of R_4 under tip of R_1; all veins reaching margin with exception of An. Halteres with a dark knob.

Length of body and wing 2½ mm.

♀ All the abdominal segments orange narrowly bordered with brown posteriorly.

A female from Ohakune has R_4 shorter and more vertical, ending in costa, about twice its length distant from tip of R_1. It is safer to consider it as an aberrant specimen rather than the representative of a distinct species so long as a male of the same locality is not obtained.

Type: Lake Brunner (Tonnoir) 2nd Feb., 1922, in Cawthron Inst. coll.

Paratypes: Nelson (Tonnoir), Nov. to Mar.; Wellington, Dec., 1921; Mt. Grey (Campbell) 23rd Feb., 1924.

The length of Sc is variable, it sometimes reaches the base of Rs; also the length of the stalk of M is rather variable.

2. Platyura subbrevis n. sp. Tonn. (Fig. 159.)

♂ *Head* brown above, mouth-parts orange, also scape of antennae, flagellum brown. *Thorax* orange, mesonotum darker with a tinge of grey. *Abdomen:* five first segments of same colouration as mesonotum, last segments and hypopygium dark brown. Hypopygium with short claspers ending in a blunt point, fig. 159. *Legs* yellowish-orange, tibiae and tarsi darker. *Wings* hyaline; Sc ending at level of base of Rs; R_4 oblique, ending at a distance from R_1 equal to its own length; An. very faint, short. Halteres with yellowish stem and darkish knob.

♀ General colouration lighter; distinct from *brevis* by the orange scape. Mesonotum not darkened, abdomen orange with sharp brown hind border to segments 2-5, the last one nearly all black. Antennae relatively shorter than in male.

Length of body 3 mm., wing 2¾ mm.

Type Aniseed Valley (Tonnoir) 1st Dec., 1923, in Cawthron Inst. coll.

Allotype: *idem.*

3. Platyura albovittata n.sp. Tonn.

♂ *Head* and appendages dark brown. *Thorax* brown, the mesonotum with dark evenly spread pubescence. *Abdomen* dark brown, hypopygium very small and hidden. *Legs* brown, femora and tibiae somewhat lighter, external spur of middle and hind tibiae much reduced. *Wings:* Sc reaching origin of Rs, R_4 rather short, placed at a good distance from R_1; An. nearly reaching the hind border; membrane brown with a transverse narrow curved band from tip of R_1 across fRs, middle of M_1 and M_2 and stopping a little before end of

Cu_1; also a lighter longitudinal space below base of M. Halteres with yellow stem and dark thick knob.

Length of body and wing 3½ mm.

Type: Reefton (Tonnoir) 13th Jan., 1922, in Cawthron Inst. coll.

4. **Platyura marshalli** nom. nov. (Fig. 163.)
Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 281 (*Platyura flava*, preoccupied).

This is a rather widespread species; the type's hypopygium as shown in fig. 163. Besides the type's locality: Lincoln, it is known from: Auckland (Broun) in Hutton's collection; Nelson, 14th and 28th Nov., 1923; Aniseed Valley, 1st Dec., 1923; Wellington, 10th Mar., 1923 (Tonnoir).

5. **Platyura lamellata** n. sp. Tonn. (Figs. 38, 161.)

♂ *Head* brownish, palpi dark, antennae with scape somewhat yellowish, especially below, flagellum dark. *Thorax* brownish, mesonotum more greyish on disc and covered with uniform black pubescence. *Abdomen* brown, posterior border of segments yellow. Hypopygium as in fig. 161; ninth tergite distinctly longer than its finger-like lateral appendages which carry only a pair of terminal bristles, lower processes hooked with a dorsal spine and a few ventral very small teeth. *Legs* yellowish, tarsi darker. *Wings* hyaline, Sc ending in front of base of Rs; M_2 and Cu_1 not reaching wings border (this is not always the case); An. incomplete. Halteres yellow.

Length of body and wing 3½ mm.

Type: Dun Mt. (Tonnoir) 5th Jan., 1922, in Cawthron Inst. coll.

Paratypes: 2 ♂ coll. Hutton without locality; Akaroa, 10th Dec., 1924—Goose Bay, 4th Feb., 1925; Christchurch 10th Nov., 1924 (Tonnoir).

Some of the specimens are much darker than type, there is no yellow at base of antennae and at posterior border of abdominal segments.

This species is very nearly related to *P. marshalli* from which it differs mainly by the structure of the hypopygium. In *marshalli* the finger-like processes are as long as the tergite, and the sternal processes are looped.

6. **Platyura proxima** n.sp. Tonn. (Fig. 162.)

♂ *Head* and antennae black, palpi and proboscis yellow. *Thorax* blackish-brown with a slight cinereous pruinosity on notum which carries uniform pubescence. *Abdomen* dark brown with inconspicuous touch of orange on posterior border and on sides of segments. Hypopygium with tergite large and bilobed and twice as long as its finger-like lateral appendages which are provided with two terminal bristles and a row of fine dorsal ciliae, sternal appendages nearly as in P. *flava*. *Legs* yellowish-brown. *Wings* hyaline; Sc reaching the origin of Rs, M_2 and Cu_1 not reaching the wing border; An. incomplete.

Length of body and wing 3½ mm.

Type: Aniseed Valley (Tonnoir) 23rd Mar., 1922, in Cawthron Inst. coll.

7. **Platyura brookesi** n.sp. Edw. (Fig. 164.)

♂ *Head* blackish above, slightly dusted with grey. Face brownish. Palpi, scape, and base of flagellum ochreous, rest of flagellum black. In ♀ the flagellar segments, except first and last, are scarcely as long as broad. *Thorax* almost uniformly brownish-ochreous, sternopleurite and hypopleurite somewhat darkened in ♂. Mesonotum not striped; uniformly clothed with short black bristles all over, without any bare lines. A group of small bristles behind prothorcic spiracles. *Abdomen* dark brown; posterior margins of tergites and the whole venter ochreous. Hypopygium much as in *P. lamellata* Tonn. and allied species; ninth tergite slightly emarginate apically but scarcely bilobed; the finger-like lateral appendage with 6-7 dorsal and 2 terminal bristles, all of about equal length. *Legs* ochreous; tarsi and spurs dark; the fine tibial setae irregularly arranged; outer spur of hind tibia half as long as the inner. First front tarsal segment slightly shorter than tibia. *Wings* clear, veins all dark. Sc ending opposite base of Rs; R_4 oblique, ending about its own length distant from tip of R_1; costa extending almost one-third of distance from R_5 to M_1; *r-m* fusion short, only about a quarter as long as stem of median fork; An. not reaching margin. Halteres ochreous.

Length of body 4½ mm.; wing 4-4½ mm.

Type: Mt. Albert, Auckland (A. E. Brooke), in Brit. Mus. coll. Allotype ♀, 1919.

8. **Platyura novae-zelandiae** nom. nov.

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 278, pl. 13, fig. 5-7. (*Platyura magna* preoccupied).

The type, a male, has the thorax orange with three dark mesonotal stripes, scutellum blackish-grey, pleurae only in part darkened; abdomen with segments 3-5 light coloured, the fourth being the palest with some whitish reflections; hypopygium testaceous.

Allotype rather light orange with only the knob of halteres and flagellum blackish.

The type and allotype, both in Prof. Marshall's collection, come from the Ruahine Mountains. Another male in Mr. Hudson's collection comes from Karori, 20th Feb., 1910.

9. **Platyura harrisi** n.sp. Tonn. (Fig. 41.)

♂ *Head* black, epistome and mouth-parts orange; antennae black, a point on under side of two first segments silvery or orange according to the position in which it is seen. *Thorax* black with conspicuous silvery gloss on pleurae and postnotum; mesonotum with cinereous dusting. *Abdomen* black, fourth segment whitish-yellow, a slight silvery gloss at base of segments 2 and 3; hypopygium dark. *Legs* anterior coxae dark at base, orange distally, hind coxae completely dark; anterior femora yellowish, posterior ones brownish; all tibiae yellowish-brown, tarsi darker. *Wings* with dark spot on anterior border towards tip, this spot growing fainter downwards, a dark suffusion on the rest of tip and one of the tip of An. Halteres brown with somewhat lighter stem.

♀ Colouration quite different from that of the male: face, episternum and mouth-parts bright orange. *Thorax* completely dark orange,

pleurae silvery as in male, mesonotum with grey dusting. *Abdomen* dark orange obscure on dorsum on account of dense adpressed pubescence. *Legs* entirely yellowish-orange, tarsi darker. *Wings* as in male. Halteres lighter.

Length of body 7½ mm., wing 6 mm.

Type: Aniseed Valley (Tonnoir) 1st Dec., 1923, in Cawthron Inst. coll.

Allotype: Riccarton (Gourlay) 19th Jan., 1923.

Paratypes: Ohakune (Harris) 15th Feb., 1920; Dallington (S. Lindsay), 10th Jan., 1922; Akaroa, 10th Dec., 1924; Hilltop, 10th Jan., 1925 (Tonnoir)

Specimens in Brit. Mus. Horn Hay (Harris) 15th Feb., 1920; Governors Bay (Tapley), 2nd Jan., 1923; (H. Crow), 3rd Dec., 1922; Gollans Valley, Wellington (Hudson); Dallington (Gourlay) Jan., 1922.

Some females from Ohakune have mesonotum with three broad and nearly confluent blackish stripes; *abdomen* nearly entirely dark on posterior half of segments. They may belong to another species; however, the males from that locality do not differ from the others.

10. **Platyura philpotti** n.sp. Tonn.

♀ *Head* blackish grey, mouth-parts orange; antennae dark brown, scape a little lighter. *Thorax:* mesonotum slate-grey, its sides somewhat rufous; pleurae and postnotum dark with silvery pruinosity. *Abdomen* shining red, flat, rather broad. *Legs* yellow-orange, posterior coxae blackish at extreme base. *Wings* conspicuously yellow chiefly on anterior border; apex somewhat smoky, chiefly between Rs and M. Tip of Sc reaching costa a good distance after base of Rs. All veins reaching wing border including An. Halteres orange.

Length of body 8½mm., wing 7 mm.

Type: Dun Mt., Nelson (A. Phillpot) 14th Dec., 1922.

11. **Platyura rutila** n. sp. Edw.

♀ *Head* black above and on face. Palpi and labium yellowish, penultimate segment of palpi blackish above at tip. Antennae entirely black; segments 2-5 of flagellum about as long as broad, the rest distinctly longer. *Thorax* covered with greyish bloom all over; mesonotal integument uniformly red, postnotum somewhat darkened; prothorax and pleurae black. Mesonotum with short black bristles, numerous at sides, also arranged in a double acrostichal row and treble dorsocentral rows, bare areas between these rows. *Abdomen* shining red. *Legs* orange, tarsi darkened; spurs and extreme base of hind coxae black. Outer spur of hind tibiae not much shorter than inner. First front tarsal segment very slightly longer than tibia. *Wings* with deep yellow tint all over, tip a little smoky below R_5; Sc reaching well beyond base of Rs; R_4 arising below tip of R_1; costa short, reaching only a quarter of the distance from R_5 to M_1; *r-m* fusion not much shorter than stem of median fork. An. reaching the margin. Halteres orange.

Length of body, 6 mm.; wing, 5½ mm.

Type: Taumaranui (T. R. Harris); taken on window, Dec., 1922, in Brit. Mus. coll.

12. **Platyura maculipennis** n. sp. Tonn. (Fig. 36.)

♂ *Head* dark brown, antennae ochreous, last six segments darker, palpi ochreous. *Thorax* ochreous-brown, pronotum and sides of mesonotum somewhat lighter. *Abdomen* uniformly ochreous-brown; hypopygium the same colour, claspers ending in a simple claw, side-pieces without long bristles. *Legs* yellowish, hind coxae with a dark streak externally, tip of tibiae 2 and 3 black. *Wings* with dark tip and spot placed on fusion of Rs and M and extending on fM, also a darkish cloud near tips of Cu_2 and A; tip of Sc a little over origin of Rs; R_4 rather long, about equal to a third of R_5. All veins reaching wing-margin including A. Halteres yellow.

♀ Similar to male.

Length of body and wing 4½ mm.

Type: Wiltons Bush (Tonnoir) 2nd Dec., 1921, in Cawthron Inst. coll.

Allotype: Wellington (Tonnoir), 1st Dec., 1921.

Paratypes: Khandallah Dec., 1921; Wairakei 6th March, 1923, Wellington 10th March, 1923 (Tonnoir).

Specimens in Brit. Mus.: Ohakune (Harris).

There is a certain amount of variation in the colouration of the mesonotum which may present traces of dark bands; the abdomen is sometimes lighter than in the type. This species has not been found yet in the South Island.

13. **Platyura punctifusa** n. sp. Edw. (Figs. 37, 165.)

♂ *Head* blackish. Labium ochreous. Palpi missing. Antennae black, only second segment partly ochreous; flagellar segments somewhat flattened, deeper than long (only the first few remaining). *Thorax* blackish, somewhat dusted with grey; shoulders extensively ochreous, also scutellum. Rather narrow shining bare stripes between lateral, dorsocentral, and acrostrichal bristles, the last named in about four irregular rows. *Abdomen* black, slightly shining, segments 3-5 obscurely ochreous at base. Hypopygium small, of the usual type, but side-pieces and claspers short; ninth tergite transverse. *Legs* brownish-ochreous,, femora darkened at base beneath, spurs black, outer spur on hind tibiae a little over half as long as inner. First tarsal segment on front legs only about two-thirds as long as tibia. *Wings* nearly clear, veins dark. Sc ending just beyond base of Rs; R_4 moderately long, arising just beyond tip of R_1; costa reaching about half-way from R_5 to M_1; *r-m* fusion very short, almost punctiform; An. slender but reaching hind margin. Halteres ochreous.

Length of body, 3·8 mm. wing, 3½ mm.

Type: Ohakune (T. R. Harris), Jan., 1924, in Brit Mus. coll.

14. **Platyura carbonaria** n. sp. Tonn.

♂ *Head* and appendages completely blackish-brown. *Thorax* black, moderately shining; mesonotum with three stripes of pubescence separated by bare lines. *Abdomen* flat, broadened distally. Hypopygium of pincers type with two teeth at end of claspers. *Legs* darkish yellow, hind coxae black, anterior ones brownish-yellow. *Wings* brownish, more intensively on anterior border; Sc reaching

costa a little over origin of Rs; all veins reaching wing-border. Halteres brown.

Length of body and wing $4\frac{1}{2}$ mm.

Type: Purau Bay, Banks Peninsula (Tonnoir) 24th Feb., 1922, in Cawthron Inst. coll.

15. **Platyura chiltoni** n. sp. Tonn.

♂ *Head* black, antennae and palpi dark brown. *Thorax* black, mesonotum with very slight greyish reflection, pubescence nearly evenly distributed. *Abdomen* shining black, much flattened and widening distally. Hypopygium rather large, apparently (seen in situ) with simple toothed claspers. *Legs* with front coxae black at base, posterior ones completely dark; femora and tibiae yellowish-brown, tarsi darker, base of posterior femora dark. *Wings* hyaline, tip of Sc slightly over origin of Rs ;R_4 short, its origin well beyond tip of R_1; all veins reaching wing-margin. Halteres brown.

Length of body and wing 3 mm.

Type: Cass (Tonnoir) 25th Feb., 1925, in Canterbury Mus. coll.

16. **Platyura campbelli** n. sp. Tonn. (Fig. 40.)

♂ *Head* orange, brownish on top, mouth-parts and base of antennae yellowish, flagellum brown. *Thorax* orange, the black pubescence of mesonotum arranged in stripes. *Abdomen* elongate and slender, four first segments orange, the following one dark brown. Hypopygium dark orange, of pincers type with two teeth at end of claspers. *Legs* yellowish. *Wings* subhyaline, Sc reaching costa slightly after origin of Rs; all veins reaching wing-border. Halteres yellow, knob brown.

Length of body 6 mm., wing 5 mm.

♀ Not so slender as the male; *abdomen* completely yellowish, flat and widened distally.

Length of body 4 mm., wing $4\frac{1}{2}$ mm.

Type: Christchurch (Tonnoir) 20th Feb., 1925, in Canterbury Mus. coll.

Allotype: Deans Bush, Christchurch (Tonnoir), 7th Mar., 1925.

Paratypes. Purau Creek, 20th Feb., 1922; Deans Bush, 10th Nov., 1924 (Heighway); Horseshoe Lake, Christchurch (Heighway) 4th Nov., 1924.

Specimens in Brit. Mus.: New Brighton, 11th Nov., 1922; Mt. Grey, Jan., 1925 (Campbell).

17. **Platyura ruficauda** n. sp. Tonn.

♂ Similar to the preceding species but not so slender; antennae relatively shorter, also yellowish at base. Palpi and face yellow, vertex brown. *Thorax* yellow, disc of mesonotum somewhat darkened. *Legs* yellow. *Abdomen* with five first abdominal segments yellowish-brown, the last ones brown. Hypopygium yellow. *Wings* and venation as in preceding species. Halteres completely yellow.

Length of body and wing 3 mm.

Type: Aniseed Valley (Tonnoir) 22nd Mar., 1922, in Cawthron Inst., coll.

18. **Platyura agricola** Marsh.
Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 279.

This is a rather common darkish species with elongate abdomen. The female differs from the male in having the mesonotum mainly ochreous with three dark stripes more or less marked; *abdomen* ochreous, tergites with lateral basal dark spots. Sometimes the male has light hind coxae.

Nelson 14th and 21st Nov., 1923; Christchurch 14th Oct., 1924, and 17th Mar., 1925; Cass, Nov., Dec., and Feb., 1924-25 (Tonnoir); Governors Bay (Tapley): White Rock (Campbell); Ohakune (Harris).

19. **Platyura curtisi** n. sp. Edw.

♂ Closely resembles *I. agricolae,* especially in venation and hypopygial structure, but differs as follows:—

Hypopleurite ochreous. First abdominal segment brownish-ochreous, hardly darkened. Hind coxae all yellowish. Knob of halteres dark.

Type: Queenstown (L. Curtis), 11th Feb., 1922, in Brit Mus. coll.

20. **Platyura rufipectus** n. sp. Tonn.

♂ *Head* greyish-brown, palpi orange also scape and basal half of the 3rd segment of the antennae the rest of which is brown. *Thorax* orange, mesonotum with three dark bands (sometimes the two external ones are present or they are all missing); hypotergites and postnotum entirely or partially obscure. *Abdomen* mostly orange, segments 2 to 5 with black base, distal segments all black. Hypopygium dark, side pieces with long bristle on internal side, claspers with two terminal teeth. *Legs* yellowish-orange, tibiae and tarsi darker. *Wings* subhyaline; tip of Sc at level of origin of Rs; R_4 rather perpendicular, not longer than distance from its tip to tip of R_1; all veins reaching wing-margin. Halteres orange, the knob somewhat infuscated (sometimes completely orange).

♀ Similar to male but lighter; only two anterior dark stripes on mesonotum, the rest of *thorax* all orange. *Abdomen* with segments 2 to 5 with dark base (sometimes the base of these segments dark only on the exterior corner).

Length of body 5½ mm., wing 4½ mm.

Type: Days Bay (Tonnoir) 28th Nov., 1921, in Cawthron Inst. coll.

Allotype: Aniseed Valley (Tonnoir) 21st March., 1922.

Paratypes: Waiho 10th Jan., 1922; Nelson 17th Sept., 1923; Reefton 13th Jan., 1922; Lake Brunner, 3rd Feb., 1922 (Tonnoir).

Specimens in Brit. Mus.: Ohakune (Harris), Dec., 1922, Dec., 1923.

There is a certain amount of variation in the colouration of the thorax which may be nearly completely orange; this species comes therefore very near the next one from which it differs, however, by the structure of the antennae and the hypopygium.

21. **Platyura ohakunensis** n. sp. Edw.

♂ *Head* black above; face, palpi, scape and under side of first two flagellar segments yellowish, remainder of antennae black. First

six flagellar segments about as long as broad, the last eight distinctly lengthened, penultimate about twice as broad. *Thorax* bright ochreous, the only dark markings being a pair of somewhat oval spots in front of scutellum, representing the darkened hind ends of the lateral mesonotal stripes, and a blackish triangle at base of postnotum adjoining scutellum. Mesonotal bristles a little longer than usual, acrostichal series in three irregular rows, separated by a rather wide bare stripe from dorsocentral series. *Abdomen* bright ochreous; black bands occupying about the basal halves of tergites 2 and 3, also a narrower black band at base of tergite 4; segments 6-8 black. Hypopygium entirely black, rather larger and stouter than in *P. rufipectus;* the three pairs of long bristles considerably stouter and set on distinct tubercles. Legs ochreous, tarsi darkened; spurs and under sides of trochanters black; hind tibial spurs subequal in length; first front tarsal segment about four-fifths as long as tibia. *Wings* slightly yellowish, veins dark; venation as in *P. rufipectus.* Halteres ochreous.

Length of body 6½ mm.; wing 5½ mm.

Type: Ohakune (T. R. Harris), Nov., 1922, in Brit. Mus. coll.

10. Genus SCIARA Mg.

This cosmopolitan genus is represented in New Zealand only by a moderate number of species. *S. rufescens,* Hutton, which is insufficiently described has been omitted from the list. Besides these described here we have in collection six to eight species represented by too scanty a materal to draw from them accurate descriptions.

1.	Branches of M and Cu with macrotrichia	2.
	Branches of M and Cu bare	8.
2.	Cell M_1 slightly constricted before the tip	3.
	Cell M_1 not constricted	4.
3.	Mesonotum dull, ochreous to brownish	1. *constrictans* Edw.
	Mesonotum shining black	2. *nubeculosa* Edw.
4.	Wing-membrane with macrotrichia at the tip	6. *xanthonota* Edw.
	Wing-membrane without macrotrichia	5.
5.	Mesonotal hair partly pale	6.
	Mesonotal hair all blackish, thorax shining black......	7. *ovalis* Edw.
6.	Veins bordered with grey; mesonotum brownish	3. *griseinervis* Edw.
	Veins not bordered with grey	7.
7.	Entirely dark species	4. *vicarians* Edw.
	At least the thorax more or less ochreous	5. *rufulenta* Edw.
8.	Cell M_1 swollen at the base, much contracted towards the tip	8. *contractans* Edw.
	Cell M_1 normal, not contracted apically	9.
9.	Each tibia with a single short spur	15. *unicalcarata* Edw.
	Posterior tibiae each with two spurs	10.
10.	R_1 ending above or scarcely before fM	11.
	R_1 ending well before fM	13.
11.	Knob of halteres pale, at least at the tip	16. *annulata* Mg.
	Knob of halteres black	12.

12.	**Mesonotum somewhat shining; scape black**	9. *zealandica* Edw.
	Mesonotum dull; scape light	10. *jejuna.* Edw.
13.	**Body all yellow**	*sp. inc.*
	Body all black, mesonotum shining	14.
14.	**Hypopygium very much swollen**	11. *philpotti* Tonn.
	Hypopygium normal	15.
15.	**Palpi yellow**	16.
	Palpi dark	17.
16.	**Mesonotum very much shining; acrostical hairs inconspicuous; no distinct hind tibial comb**	13. *harrisi* Edw.
	Mesonotum moderately shining with distinct rather numerous acrostical hairs; a distal hind tibial comb	12. *marcilla* Hutt.
17.	**Hypopygium with ventral basal hair tuft**	17. *agraria* Felt.
	Hypopygium without hair tuft	14. *tapleyi* Edw.

1. **Sciara constrictans** n. sp. Edw. (Fig. 177.)

Head blackish, heavily dusted with grey. Eye-bridges in contact and 3-4 facets wide; middle ocellus touching eye-bridge. Antennae with scape ochreous, except in the darkest specimens, where it is sometimes dark brown; flagellum black; flagellar segments in male nearly four times as long as broad (the first two or three rather shorter), with short necks, pubescence a little longer than diameter; flagellum of female not much shorter than that of male. Palpi yellowish; first segment broad; second slender, about twice as long as broad, third half as long again as second. *Thorax* dull rather variable in colour, mesonotum usually ochreous or brownish-ochreous, with four chestnut-brown stripes, which in the lightest specimens are almost obsolete and in a few of the darkest are practically black and almost confluent; interspaces more or less dusted with grey; pleurae mainly or entirely blackish or dark brown. Acrostichal and dorsocentral hair pale, mixed with some longer black bristles posteriorly; Scutellum with 6-8 marginal black bristles. *Abdomen* dark brown; tergites 2-5 or at least 3 and 4 generally more or less yellow at base in middle; in the lightest specimens there are almost complete transverse yellow bands. Segments 5-7 in female mainly membranous, light brownish, with a pair of narrow dark sublateral stripes where the chitin is thicker. Hair generally pale, but dark in some of the darker specimens. Male claspers about three times as long as broad, tip rounded, with one rather strong apical spine; on inner side towards tip about 6-10 bristles. Last segment and anal lamallae of female black. *Legs* slender, ochreous, tibiae and tarsi darkened; spurs yellow, about twice as long as tibial diameter; hind tibial comb indefinite. Claws moderately large, with tuft of hairs at base, but without teeth. *Wings* nearly hyaline, veins all dark except base of stem of M which is faint; outer third or half of stem of median fork and branches of M and Cu setose, in the darker specimens often rather distinctly though narrowly margined with grey. R_1 about as long as R and ending just before fM; R_5 gently curved, ending just proximal to tip of M_3 in ♂, but above or slightly distal to it in ♀; costa extending over two-thirds of distance from R_5 to M_1; *r-m* about as long as basal section of M; median fork slightly but generally quite distinctly constricted beyond middle; stem of cubital fork moderately long; An.

very short. Halteres mainly ochreous, base of club generally more or less darkened.

Length of body, ♂ 2·8-3·5 mm.; ♀ 4-5 mm.; wing, ♂ 2·8-3·2 mm., ♀ 3½-5 mm.

Apparently common throughout the country. Type ♂ and allotype ♀ : Ohakune (T. R. Harris),. Sept., 1922, in Brit. Mus. coll. Other specimens from Ohakune (Harris); Otira, Clifton and White Rock (Campbell); Governors Bay (Tapley); Queenstown and Ben Lomond (Curtis); Dunedin (Fenwick); Kaikoura 22nd Feb., 1922; Mt. Arthur, 26th Dec., 1921; Waiho 19th Jan., 1922; Cass, 21st Feb., 1925; Goose Bay, 5th Feb., 1925 (Tonn.).

2. **Sciara nubeculosa** n. sp. Edw. (Figs. 42, 183.)

Very similar to *S. constrictans* in structural characters, venation and hypopygical characters being the same, but differs as follows:—

Palpi and scape of antennae dark. *Thorax* almost entirely shining black; no distinct black bristles among the pale dorsocentral hairs. *Abdomen* of male shining black, of female dark brown. Posterior coxae dark. Posterior veins more distinctly grey-bordered; a dark cloud over base of median fork, and the narrow portion of cubital fork filled out with dark grey; these markings more distinct in female than in male. Knob of halteres mainly dark.

Type ♂ and paratype ♀ : Dunedin (C. C. Fenwick), in Brit Mus- coll.; Ohakune (T R. Harris); 1 ♀, Mt Arthur, 21st Dec., 1921 (Tonn.).

3. **Sciara griseinervis** n. sp. Edw. (Fig. 188.)

Similar in structure and colour to *S. constrictans,* differing as follows:—

Size smaller. Antennae a little shorter. Yellow marks on abdomen only on segments 2 and 3, sometimes very small or absent. Anal lamellae of female ochreous. Veins rather more distinctly margined with grey, especially the branches of M and Cu. R_1 distinctly shorter than R, and ending further from fM. R_5 rather straighter and ending in both sexes distinctly proximal to tip of M_3. Stem of median fork entirely faint and with few or no macrotrichia; fork not at all constricted. Knob of halteres entirely blackish.

Length of body, about 2 mm.; wing about 2½ mm.

Type ♂ : Dunedin (C. C. Fenwick), in Brit. Mus. coll. Paratype 6 ♂ 5 ♀.

Although the hypopygium seems identical with that of *S. constrictans,* the differences enumerated above appear constant and will suffice for the separation of the species.

4. **Sciara vicarians** n. sp. Edw. Fig. 175.)

Very similar to the darkest form of *S. constrictans,* the hypopygium being the same, and the mesonotum having numerous small pale hairs mixed with black bristles on the dorso-central stripes; but size smaller; palpi somewhat darkened, scape of antennae black; *thorax* all black, at least in the male, and with less conspicuous grey dusting between the four bare mesonotal stripes; *abdomen* all black; R_1 rather longer

and ending almost opposite fM; median fork not constricted; veins not at all dark-margined.

Length of body, 2½-3 mm.; wing 3-4 mm.

Type ♂: Governors Bay (J. F. Tapley), in Brit. Mus. coll.; paratype 4 ♂ 1 ♀; Mt. Arthur, 20th Dec., 1921; Hill Top, 16th Jan., 1925 (Tonn.)

This is extremely similar to the European *S. autumnalis* Winn.; but there is a slight difference in the shape of the clasper, and the abdominal hair is mainly or all dark. Since there are several nearly allied but clearly distinct species of this group in New Zealand, some of which appear to be indigenous, it is perhaps wisest to treat this form also as distinct from the European one.

5. **Sciara rufulenta** n. sp. Edw. (Figs. 173, 174.)

♂ *Head* dark brown above, heavily dusted with grey. Face yellowish. Eye-bridges three facets wide and in contact; middle ocellus touching the point of junction. Antennae with scape ochreous, flagellum black, segments barely three times as long as broad in male, about twice as long as broad in female. Palpi yellow, first two segments subequal, last longer. *Thorax* in typical form almost uniformly ochreous, only middle part of pleurae darker. Mesonotum somewhat shining, bristles and hair all black; acrostichal hairs short, in two rows; dorsocentral hairs practically in one row, mostly long and bristly, with a few short ones towards the front between the longer bristles. Scutellum with 4-6 marginal bristles. *Abdomen* dark brown, without yellow markings dorsally, lateral membrane and venter ochreous, more conspicuously so in female. Hypopygium ochreous, in structure almost identical with that of *S. constrictans*, but the clasper more pointed at tip. Anal lamellae of female dark brown. *Legs* ochreous, claws and spurs as in the other species of this group. *Wings* hyaline, anterior veins dark, posterior veins paler. Branches of M and Cu setose, also the end of stem of median fork, especially in female. Venation as in *S. constrictans*, except that R_1 is slightly shorter than R, and the median fork is not at all constructed. Knob of halteres entirely blackish.

Length of body, 2-2½ mm.; wing 2½-3 mm.

Type: Dunedin (C. C. Fenwick); paratypes 3 ♂ 8 ♀.: Kaitouna 23rd Feb., 1922; Otira 9th Nov., 1922; Mt. Arthur Dec., 1922; Waiho 29th Jan., 1922; Nelson 5th Sept., 1922; Hill Top, 16th Jan., 1925; Lake Brunner 5th Feb., 1922.

This may perhaps be Hutton's *S. rufescens* which was described from Dunedin, although the shorter vein R_1 is inconsistent with Hutton's description. In any case his name is preoccupied by *S. rufescens* Zett.

Besides the typical form described above numerous specimens have been examined from Ohakune (Harris) and Governors Bay (Tapley) in which the thorax is darkened wholly or in part. The lightest specimens are darkened only on the anterior part of the sternopleura; others have the whole sternopleura and pleurotergites blackish, and in a few extreme forms the mesonotum is also almost wholly blackish, as well as the scape of the antennae. Structurally no differences are apparent, and these specimens are therefore regarded as dark varieties of *S. rufulenta*.

6. **Sciara xanthonota** n. sp. Edw.

♀ Resembles the typical form of *S. rufulenta* rather closely, differing as follows:—

Face blackish. Middle part of pleurae darker, contrasting with the ochreous sternopleura and mesonotum. Lamellae of ovipositor brownish-ochreous. R_1 rather longer, almost reaching level of fM. Membrane of wings with rather numerous macrotrichia at tip in cells M_1 and M_3.

Length of body, 3 mm.; wing, 3½ mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes 8 ♀ Nov.-Dec., 1922 and Nov., 1923.

7. **Sciara ovalis** n. sp. Edw. (Fig. 176.)

♂ *Head* black, somewhat shining above, face dull. Eye-bridges in contact and three facets wide. Antennae all black, flagellar segments under three times as long as broad, pubescence as long as diameter. Palpi brownish ochreous, segments subequal in length. Thorax black, moderately shining, without grey dusting; mesonotal hairs all black; acrostichals very short and sparse, dorsocentrals also rather short; scutellum with four longish marginal hairs and some shorter ones. *Abdomen* dark brown above, lighter beneath. Hypopygium black, of moderate size; claspers oval, about twice as long as their width in middle, with a number of curved hairs on inner side towards tip. *Legs* ochreous, tarsi darkened; spurs brownish, about half as long again as diameter of tip of tibia; no definite hind-tibial comb. *Wings* slightly and uniformly greyish; branches of M and Cu setose; venation as in *S. griseinervis* except that R_5 ends almost level with tip of M_3. Halteres black except for base of stem.

Length of body, 2·2 mm.; wing, 2·8 mm.

Type: Ohakune (T. R. Harris); Nov., 1922, in Brit. Mus. coll.

8. **Sciara contractans** n. sp. Edw.

♀ *Head* shining black above, face dull blackish. Eye-bridges three facets wide and not quite touching; middle ocellus placed a little behind bridge. Antennae blackish, flagellar segments about two and a half to three times as long as broad. Palpi yellowish, first two segments subequal in length, third about twice as long as second. *Thorax* shining black, except scutellum and postnotum, which are dull black; mesonotal hairs short and inconspicuous. *Abdomen* brownish-ochreous, last two segments and ovipositor black. *Legs* ochreous; tarsi darkened; tibial spurs very short; claws moderately large and simple. *Wings* greyish, all veins darkened; branches of M and Cu bare. R_1 considerably shorter than R, but ending above or scarcely before fM; R_5 strongly curved, ending just distal to tip of M_3; costa reaching just over half-way from R_5 to M_1; median forks strongly narrowed towards tip; *r-m* about as long as basal section of M; stem of cubital fork moderate; An. obsolete. Halteres black.

Length of body, 3 mm.; wing, 3½ mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; Nov., 1922; paratype ♀ May-July, 1923.

A very distinct species, approaching the genus *Zygoneura* in venation.

9. **Sciara zealandica** n. sp. Edw. (Fig. 180.)

♂ *Head* black, scarcely shining above, face dull and rather narrow. Eye-bridges three facets broad and in contact in middle, slightly narrowed near eyes. Antennae black, flagellar segments in male with short necks, about two and a half times as long as broad, in female shorter and more slender. Palpi black, rather short, the three segments subequal in length. *Thorax* black, slightly shining, hair black, dorsocentral hair longish, acrostichal short and inconspicuous. *Abdomen* black, black--haired. Hypopygium moderately large, without basal ventral hair-patch, claspers stout, with a pair of longish curved bristles at the tip on inner side. *Legs* dark brown, almost black, front coxae and femora lighter. Spurs brownish, rather longer than tibial diameter; comb rather well-marked. *Wings* smoky, all veins darkened, branches of M and Cu bare. R_1 a little shorter than R, ending above or scarcely before fM; R_5 nearly straight, ending just proximal to tip of M_3; costa reaching over two-thirds of distance from R_5 to M_1; *r-m* distinctly or much shorter than basal section of M; branches of median fork parallel and nearly straight; An. short. Halteres black.

Length of body, ♂ 2-2½, ♀ 3 mm.; wing, ♂ 2·3-2·8, ♀ 3½ mm.

Type: Okauia, Matamata (A. E. Brookes), in Brit. Mus. coll.; paratypes 1 ♂ 2 ♀, 18th Nov., 1922; Mt. Ruapehu, 4000 ft., (T. R. Harris); 1 ♂ Ohakune (T. R. Harris); 1 ♀ White Rock (J. W. Campbell); 1 ♂ Nov., 1922; Aniseed Valley, 22nd Mar., 1922; Okarahia, 5th Feb., 1922; Lake Brunner, 5th Feb., 1922; Cass, 21st Feb., 1925; Nelson, 28th Nov., 1923 (Tonn.).

10. **Sciara jejuna** n. sp. Edw. (Fig. 181.)

Resembles *S. zealandica,* but of slenderer build; scape of antennae light brownish; mesonotum quite dull; male claspers with a tuft of hairs at tip; legs lighter brown; costa longer, reaching over four-fifths of the distance from R_5 to M_1.

Type ♂ : Ohakune (T. R. Harris), Nov., 1923, in Brit. Mus. coll.; allotype ♀ May-July, 1923.

11. **Sciara philpotti** n. sp. Tonn. (Fig. 189.)

♂ *Head* black vertex shining, face dull, very narrow; palpi yellowish; antennae broken. *Thorax* little shining dorso-central hairs somewhat long behind, acrostrichal row composed of only one line of a few small hairs on anterior half of mesonotum. Scutellum with two apical bristles and a few hairs. *Abdomen* dull black with dark pubescence. Hypopygium very large, swollen, and as long as half of the rest of the abdomen and also much wider than abdomen, claspers hemispherical (fig. 189). *Legs* yellowish, spurs a little longer only than tibial diameter; no distinct hind tibial comb. *Wing* subhyaline, posterior veins rather weak; no macrotrichia on M or Cu; *r-m* equal to the basal section of M; R_1 not reaching the level of fM; tip of R_5 over level of tip of M_3; tip of costa at ⅞ of distance between R_5 and M_1; branches of M subparallel. Halteres with dark knob and yellow stem.

Length of body 2 mm., wing 2½ mm.

Type: Aniseed Valley (Tonn.) 22nd Mar., 1922, in Cawthron Inst. coll.

12. **Sciara marcilla** Hutt. (Fig. 185.)
Hutton, *Trans N.Z. Inst.*, 34, 1901, pl. 192.

The description of the type should be completed as follows:—♂ *Head* black, slightly shining on vertex; face dull, as wide as basal segment of antennae; eye-bridge 2-3 facets wide; antennae entirely dark, flagellar segment twice as wide as long; palpi yellowish. *Thorax* black, mesonotum slightly shining with distinct rows of dorsocentral and acrostical hairs; shoulders slightly ferrugineous; scutellum with two apical bristles and a few shorter hairs. *Abdomen* less shining than thorax, dark brown with dark pubescence. Hypopygium with claspers rather similar to that of *S. constrictans* but terminal bristles more numerous. *Legs* dark ochreous. Tibial spurs equal to tibial diameter; hind tibial comb present. *Wing* clear, veins dark; branches of M and Cu bare; R_1 ending much before fM; tip of R_5 in front of that of M_3; tip of costa half way between R_5 and M_1; *r-m* equal to basal section of M; branches of M slightly divergent at end. Halteres with yellow stem and black knob.

Length of body and wing 2½ mm.

Type in Canterbury Mus. coll. without locality label.

13. **Sciara harrisi** n. sp. Edw. (Fig. 187.)

♂ *Head* black, somewhat shining on the vertex, face dull and narrow. Eye-bridges 2-3 facets wide. Antennae black, flagellar segments barely twice as long as broad. Palpi clear yellow, the three segments subequal in length. *Thorax* black, mesonotum considerably shining, with short black dorsocentral hair and very short and inconspicuous acrostrichal hair; scutellum with two black marginal bristles and some shorter hairs. *Abdomen* dull black, black-haired. Male hypopygium rather small, without ventral hair-patch, claspers rather elongate oval, with about four curved bristles on inner side at tip. *Legs* ochreous, tarsi darkened; spurs a little longer than diameter of tibia; no definite hind tibial comb. *Wings* nearly clear, all veins more or less darkened; branches of M and Cu bare. R_1 much shorter than R and ending well before fM; R_5 nearly straight and ending a little proximal to tip of M_3; costa reaching two-thirds of distance from R_5 to M_1; *r-m* shorter than basal section of M; branches of median fork slightly divergent apically, at least in male. Halteres with black knob.

Length of body or wing, 2-2½ mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes 2 ♂ 4 ♀; Dunedin (C. C. Fenwick); 1 ♂; Goose Bay, 4th Feb., 1925 (Tonn.).

A male from Utiku, 27th July,, 1917, and another from Mataroa, 30th Aug., 1917 (A. E. Brookes) differ from *S. harrisi* in having a strong apical spine on the clasper in addition to the subapical bristles, the structure being almost the same as in the American *S. actuosa*.

14. **Sciara tapleyi** n. sp. Edw. (Fig. 186.)

Closely resembles *S. harrisi* except that the palpi are dark brownish and the male claspers have a different form, being broadest before middle, tapering towards tip, which bears a short stout claw, the outer two-thirds with a few straight stiff bristles on inner side.

Type ♂ : Governors Bay (J. F. Tapley), in Brit. Mus. coll.; paratype 3 ♂ 1 ♀ ; Ohakune (T. R. Harris); 2 ♂ 2 ♀ ; ? Okauia (A. E. Brookes); 2 ♀.

15. **Sciara (Scatopsciara** n. subgen.) **unicalcarata** n. sp. Edw.

♀ *Head* dull black. Eye-bridges narrow, three facets wide at their origin, but narrowed to points separated by the width of two facets; middle ocellus well removed from eye-bridges. Antennae black, flagellar segments about twice as long as broad. Palpi black, middle segment shortly oval, much shorter than either first or third. *Thorax* dull black, hair all pale yellowish. Dorsocentral and acrostichal hairs in double rows, all about equally long. Scutellum with two short bristles and some shorter hairs. *Abdomen* dull blackish-brown; anal lamellae round. *Legs* dark brown, almost black. Each tibia with a single short spur, which is only about half as long as tibial diameter; hind tibiae with a strongly developed apical comb on inner side. *Wings* nearly clear; anterior veins strongly, posterior veins slightly darkened. Branches of M and Cu bare. R_1 much shorter than R and ending well before fM; R_5 slightly curved and ending just distal to tip of M_3; costa reaching nearly two-thirds of distance from R_5 to M_1; *r-m* about as long as basal section of M; branches of median fork straight and parallel; stem of cubital fork rather short; An obsolete. Halteres black.

Length of body 3 mm., wing 3 mm.

Type ♀ : Governors Bay (J. F. Tapley), 8th Sept., 1922, in Brit. Mus. coll.

In the absence of the inner spurs of the four posterior tibiae and the strongly developed hind tibial comb, as well as the short middle segment of the palpi this differs markedly from nearly all other species of the genus, and it seems justifiable to place it in a separate subgenus, for which the name *Scatopsciara* is proposed. The European S. *quinquelineata* Macq. has similar legs and palpi and may be regarded as the type of the subgenus. Another Oriental species of this group is also known to the junior author.

16. **Sciara annulata** Mg. (Figs. 43, 182.)

Numerous specimens from Ohakune, Governors Bay, Christchurch, White Rock, Nelson, Akaroa and Kaikoura. As in European examples the colour is rather variable, the halteres being sometimes almost completely black. Specimens (1 ♂ 2 ♀) from Mt. Albert and Titirangi (Brookes) apparently represent a light variety with yellowish coxae, less smoky wings and completely pale halteres.

The North American *S. prolifica* Felt. appears to be the same species, which is probably cosmopolitan.

17. **S. agraria** Joh. (Figs. 178, 179.)

Utiku, King Country (A. E. Brookes). Dunedin (C. C. Fenwick).

11. Genus SCYTHROPOCHROA End.

This genus is known only from the Seychelles, the Malayan region and New Zealand.

Scythropochroa nitida n. sp. Edw. (*? Mycetophila anarctica* Hudson.) (Fig. 44.)

♀ *Head* black, somewhat shining. Eye-bridges 3-4 facets wide and separated by about the width of two facets; face broad. Antennae black, flagellar segments about half as long as broad. Palpi rounded, black. *Thorax* shining black, mesonotum with three duller stripes, under dorso-central and acrostrichal hair, the former in about 3-4 the latter in two rows. Scutellum hairy all over. *Abdomen* dark brown, almost dull. Anal lamellae slightly deeper than long. *Legs* rather short, dark brownish-ochreous; spurs ochreous; claws rather large, swollen at base. *Wings* smoky; anterior veins dark; M and Cu bare. R_1 longer than R and ending slightly beyond fM; R_5 ending just distal to tip of M_3; costa reaching about three-quarters of distance from R_5 to M_1; median fork rather shorter than its stem, branches rather strongly divergent; base of cubital fork a little beyond the base of stem of median fork. Halteres black.

Length of body, or wing, 4½-5 mm.

Type: Little River, Christchurch (? E. S. Gourlay), in Brit. Mus. coll.; paratype 2 ♀, Jan., 1922; Waikari (? J. W. Campbell); 1 ♀ 19th Feb., 1919; Ohakune (T. R. Harris); 1 ♀ Dec., 1922; Reefton, 13th Jan., 1922; Aniseed Valley, 1st Dec., 1923 (Tonn.)

12. Genus OHAKUNEA nov.

Eyes bare; dorsal bridges broad but short, rather widely separated in the middle; ocelli rather close together, the laterals practically touching the eyes. Labium short. Palpi three segmented, apart from the rather long palpiger. Mesonotum with long bristles; pleurae bare; pleurotergites almost flat. *Abdomen* rather short, but seventh segment not retracted and even eighth visible externally. Hypopygium: ninth tergite large, swollen, spiny beneath; anal segment hidden beneath base of ninth tergite; claspers peculiar and totally unlike those of other Sciarinae. *Legs* slender; tibiae without bristles; spurs very short; claws small and simple; empodia small. *Wings* clothed with dot-like microtrichia and long curved macrotrichia over entire surface. Sc evanescent apically; Sc_2 near its base. Costa not extending beyond tip of R_5. Rs short and transverse, placed beyond middle of wing and above base of median fork; stem of median fork arising near base of wing; *r-m* therefore long, even longer than R_5. Cubital fork sessile, Cu_1 very faint towards the base.

Genotype, *O. bicolor*, n. sp.

Although this remarkable genus must evidently be referred to the Sciarinae on account of the venation and the presence of fairly definite eye-bridges, it is sharply marked off from all the other members of the subfamily by the very peculiar hypopygium, the excessively long *r-m* and the unproduced costa.

Ohakunea bicolor n. sp. Edw. (Figs. 45, 190, 191.)

♂ *Head* black; lower part of face and labium orange. Palpi black, last two elongate, longer than the first two together. Antennae with scape orange, flagellum black; flagellar segments cylindrical, rather elongate, but gradually becoming shorter apically, in both

sexes clothed with uniform long dense pubescence about twice as long as diameter of segments. Eye-bridges separated in middle by about the width of four of the large facets; broadest towards eyes. *Thorax* uniformly dull orange, bristles black; two very long ones and a few shorter ones on scutellum; dorsocentrals long; acrostichals short and inconspicuous. *Abdomen* blackish above, brownish below, genitalia ochreous; hypopygium as in figs. 190, 191; ovipositor with hairy oval lamellae. *Legs* with the coxae and trochanters orange, the rest black. First front tarsal segment fully as long as tibia. *Wings* appearing rather dark owing to the vestiture of macrotrichia; venation as in fig. 45. Halteres with pale stem and black knob.

Length of body, about 2½-3 mm.; wing, 3·2-3·7 mm.

Type: Ohakune (T. R. Harris); Mar., 1923, in Brit. Mus. coll.; allotype ♀ April, 1923; Mt. Grey (J. W. Campbell); 1 ♂, 23rd Feb., 1924; Kaikoura 19th Feb., 1922; Goose Bay, 4th Feb., 1925; Lake Brunner 4th Feb., 1922 (Tonn.).

130. Genus NEOPHNYXIA nov.

The diagnosis of this genus can be established only on the female, the male being still unknown; it is very closely related to *Phnyxia* but the eyes are conspicuously smaller and the legs much more reduced in size. In spite of the non-bridged eyes it has been found preferable to place this genus among the Sciarinae rather than among the Sciophilinae on account of the close affinities with Epidapus.

Genotype: *N. nelsoniana* n. sp.

Neophnyxia nelsoniana n. sp. Tonn. (Figs. 120-122, 192-194.)

♀ *Head* oval, elongate; antennae with their bases subcontiguous, inserted on foremost part of head, composed of 16 segments; scape as long as broad, pedicel twice longer, subpyriform; flagellar segments shorter than broad, with moderately numerous setae about as long as segments are high; last segment obconical, blunt, the whole antenna not quite twice as long as head. Eyes rounded placed right against the base of antennae and composed each of 25-30 round facets. Ocelli three, in a triangle at level of posterior margin of eyes which are well distant from them, no bridge being present. Palpi composed of one single round segment with a couple of setae at the end and a few sensory cones. *Thorax* composed only of the two pronotal lobes, which are much more chitinous than the rest of body, and of a cylindrical segment representing the meso- and meta-thorax fused together without any trace of sutures between the slerites. *Abdomen* with eight cylindrical segments, the last one conical, with terminal lamellae; each of the first eight segments does not show any trace of suture between tergum and sternum, their integuments are composed of a granulous membrane, the granulations of which are being formed by groups of 5-9 microscopical cones ending in a short seta; the integuments of thorax with exception of pronotal lobe are similar. The abdominal spiracles can be distinguished only on segments 1-7. The anal lamellae as in most Sciarinae, the subgenital plate more chitinous than the rest of abdomen and carrying a few sensory setae, no

granulations. *Legs* relatively short; femora somewhat flattened, tibiae a little longer than femora, the hind ones distinctly wider than the others; the two pairs of posterior tibiae with a pair of moderately long spurs, the external one being the longer. Front tibiae with only one spur. Tarsi distinctly longer than tibiae, somewhat flattened dorso-ventrally; first segment a little more than twice as long as wide, segments 2-4 subequal to each other and about as long as wide when seen from above; terminal segment twice as long as wide, oval; claws simple, empodium scarcely distinct even at a high magnification. No trace of wings or halteres.

Length of body: 1·6 mm.; legs (average) 0·6 mm.; head 0·2 mm.

Type: Nelson, Grampian Hill, 24th Sept., 1922 (Tonn.), in Cawthron Inst coll.

14. Genus MANOTA Williston.

This peculiar genus is found also in South America, the West Indies, Central Europe, Seychelles and Ceylon.

Manota maorica n. sp. Edw. (Fig. 85.)

♂ *Head* blackish above and behind, face ochreous. Orbital bristles black. Antennae with scape ochreous, first five or six flagellar segments pale ochreous beneath, darkened above, obliquely articulated, somewhat flattened, hardly longer than broad; remaining segments blackish, rather longer than basal ones, penultimate being nearly twice as long as broad; pubescence short, hardly half as long as vertical diameter of segments. Palpi pale ochreous. *Thorax* dark brown, scarcely shining; pronotal lobes rather lighter; propleura and lower part of sternopleura ochreous; hair dark; the only strong bristles are two long ones on scutellum. *Abdomen* blackish, with black hair; claspers ochreous. *Legs* pale ochreous; tarsi darkened; spurs black the four posterior femora blackish all round at base. *Wings* with the basal half clear, the outer half smoky, the division being oblique, the clear area extending further on the anterior margin. Halteres with ochreous stem and black knob.

Length of body or wing, about 2·2 mm.

Type: West Coast of South Is. (? Greymouth) (T. R. Harris), Feb., 1923, in Brit. Mus. coll.; paratype: 1 ♂, same locality and date; Blackball (J. W. Campbell) 1 ♂, Jan., 1925. Aniseed Valley, 1st Dec., 1923 (Tonn.).

This species bears a close resemblance to the other species of the genus (*M. defecta* Will. from West Indies; *M. flavipes* End. from Seychelles; *M. orientalis* Senior-White from Ceylon; *M. coxata* End. from Brazil; and *M. unuifurcata* Leindst. from Central Europe) differing chiefly in details of the antennae and hypopygium.

15. Genus MYCOMYIA Rond.

The N.Z. representatives of this cosmopolitan genus differ little from those of palearctic regions, but in New Zealand they are not a conspicuous element of the Mycetophilidae fauna.

Key to Species.

1. Wings with dark markings	1. *flavilatera* Tonn.
Wings unmarked	2.
2. Mesonotum in ♂ with distinct dark bands, the median one divided by a pale line; hypopygium small and dark; mesothoracic band not very distinct in ♀	3. *furcata* Edw.
Mesonotum dark on the disc but without distinct bands; hypopygium large and yellow	2. *plagiata* Tonn.

1. **Mycomyia flavilatera** n. sp. Tonn. (Figs. 46, 171, 172.)

♂ *Head* brown, face yellow, palpi dark; base of antennae up to 4-5 segment yellow, the rest brown. Mesonotum brown with three pale stripes, the middle one with a fine median dark line; scutellum, disc of postnotum, and the hypotergites brownish. *Abdomen:* first segment yellow, the others with a yellow hind border, the second and third with a narrow yellow base. Hypopygium yellow, very small, and hidden, its structure as in figs. 171, 172. *Legs* yellow. *Wings* with dark brown spot on tip of Sc and the little cell, most of distal half with a slight even shadow. Sc_1 present, Sc_2 past the middle of the little cell, stem of M shorter than M_3, fCu before the level of *r-m*. Halteres yellow.

♀ Similar to male.

Length of body 4½ mm., wing 5 mm.

Type: Khandallah (Tonnoir) 30th Nov., 1921, in Cawthron Institute coll.

Allotype: Kaikoura 22nd Feb., 1922 (Tonnoir).

Paratypes: Aniseed Valley 1st Dec., 1923; Cass 2nd Dec., 1924 (Tonnoir).

Specimens in Brit. Mus., Ohakune, Raetihi Hill (Harris), and Queenstown (Curtis) Sept., 1922, 25th Mar., 1923, Mar.-April, 1923, Oct.,-Nov., 1923.

2. **Mycomyia plagiata** n. sp. Tonn. (Figs. 168-170.)

♂ *Head* and palpi brown; antennae with scape and first segment of flagellum yellowish. Mesonotum somewhat shining, brown anteriorly and on disc, sides yellow as well as pleurae; scutellum and postnotum darker. *Abdomen* brown; hypopygium yellowish, its structure as shown in figs. 168-190. *Legs*, yellowish. *Wings* unmarked, Sc_1 absent, Sc_2 just on the middle of the little cell; stem of M as long as M_1; fCu at level of tip of Sc. Halteres dark yellow.

♀ Similar to male, venter yellow.

Length of body 3 mm., wing 3½ mm.

Type: Waiho (Tonnoir) 19th Jan., 1922, in Cawthron Inst., coll.

Allotype: *idem* 16th Jan.

Paratopotypes: same dates.

Specimens in Brit. Mus., Ohakune and Raetihi Hill (Harris).

3. **Mycomyia furcata** n. sp. Edw. (Figs. 49, 168, 169.)

♂ *Head* as in *M. plagiata*. *Thorax* brownish-ochreous dorsally, somewhat shining, mesonotum with three separate dark brown stripes, the middle one almost completely divided by a pale line; in the female these stripes are faint. Postnotum dark apically; pleurae largely

dark brown, almost black. *Abdomen* dark brown, posterior margins of segments lighter. Hypopygium much smaller than in *M. plagiata* and very different in structure (see figs. 168-169). *Legs* ochreous. Posterior coxae somewhat darkened; all coxae simple. *Wings* as in *M. plagiata*. Halteres clear yellow, knob not in the least darkened.

Length of body and wing 4 mm.

Type and allotype: Ohakune (Harris) 10th Nov., 1922, in Brit. Mus. coll.

16. Genus ALLOCOTOCERA Mik.

This genus has been recorded so far only from Europe and North America.

KEY TO SPECIES.

1. Wings with a scarcely noticeable shadow on the tip; palpi in male not incrassate; female nearly entirely orange	2.
Wings with a distinct apical dark marking; base of the palpi incrassate in male	3.
2. Stem of M short, equal to twice the length of *r-m*......	1. *anaclinoides* (Marsh.)
Stem of M long, equal to a third of its fork; microtrichia present on the basal part of the wing	2. *cephasi* Edw.
3. Antennae nearly entirely black, no brown shadow round *r-m*	3. *dilatata* Tonn.
Antennae of male mostly orange on the basal half, a brown shadow round *r-m*	4. *crassipalpis* Tonn.

1. Allocotocera anaclinoides (Marsh.). (Fig. 198.)

Marshall, *Trans N.Z. Inst.*, 28, 1896, p. 292 (Euryceras).

The hypopygium of the type is shown in fig. 198. The colouration of the *thorax* is rather variable in male; sometimes pleurae are not completely dark but only inferior part of hypotergites and pleurotergites. In other cases mesonotum is completely black on disc and pleurae are also extremely dark with exception of region in front of wings base. The base of Cu_2 is obsolete in some specimens.

The female which was not known to Prof. Marshall is completely orange with exception of flagellum of antennae which is brown. The base of abdominal segments 3-5 is somewhat brownish. *Wings* yellowish chiefly on anterior border.

The type came from Mt. Torlesse; other specimens have been collected in Nelson, 15th Dec., 1921; Mt. Arthur, 25th Dec., 1921.

Allotype, Nelson, 15th Dec., 1921.

2. Allocotocera cephasi n. sp. Edw. (Fig. 57.)

♀ *Head* shining black above, face dull black, ocelli in a straight line, laterals about their own diameter distant from eye-margins. Antennae black, first few flagellar segments rather stout, about half as long again as broad, last few gradually more slender and elongate, penultimate almost three times as long as broad. Palpi rather short, black, basal segment not swollen. *Thorax* shining black, posterior division of pronotum and a small patch above front coxae light yellow. Bristles all yellowish. Pleurotergites and postnotum hairy. *Abdomen* shining black, posterior margins of segments yellow, especially on seg-

ment 4-6. *Legs* with coxae blackish; femora ochreous, posterior pairs indistinctly darkened at base beneath, and at extreme tips; tibiae brownish-ochreous; spurs and tarsi dark brown. *Wings* greyish, unmarked. Macrotrichia small and very dense; microtrichia absent on outer two-thirds but numerous on about basal third. Sc reaching far beyond base of Rs; Sc_2 well before middle of Sc; costa only slightly produced; stem of median fork rather long, about one-third as long as fork; base of cubital fork immediately before base of *r-m*. Halteres yellow.

Length of body, 5 mm.; wing, 5 mm.

Type: McKinnon Pass (C. L. Edwards), caught on snow, 3rd Apr., 1923, in Brit. Mus. coll.

3. **Allocotocera dilatata** n. sp. Tonn. (Fig. 58.)

♂ *Body* entirely brown with exception of upperside of two first antennal segments which is orange. Halteres yellow. *Legs* yellow, tip of middle coxae and base of middle femora brownish, hind coxae base and tip of hind femora brown. Second segment of palpi dilated. Mesonotum rather shining on disc with a slight grey pruinosity on the sides. *Abdomen* shining. All pubescence of body yellowish. *Wings* hyaline except on the distal fourth which is brownish and more so on the anterior border, a slight shadow, also under Cu_2.

♀ Much lighter than male; palpi and basal half of antennae orange, palpi normal and not so long. *Thorax* mostly orange, mesonotum with a darkish stripe in middle. First abdominal segment and posterior border of others orange.

Length of body and wing 3½ mm.

Type: Lake Brunner (Tonnoir) 4th Feb., 1922, in Cawthron Inst. coll.

Allotype: Goose Bay, 4th Feb., 1925.

Paratypes: Aniseed Valley, 1st Dec., 1923; Nelson, 1st Sept., and 8th, 17th, 21st, Nov., 1923; Deans Bush, 21st Oct., 1924; Akaroa, 12th Dec., 1924 (Tonnoir).

Specimen in Brit. Mus.: White Rock, 26th Nov., 1922 (Campbell).

4. **Allocotocera crassipalpis** n. sp. Tonn.

♂ *Head* brown, second palpal segment deep black and much dilated in a lobe on external side, two last segments thin, yellow. Antennae longer than head and thorax together, segments of flagellum rather wide and flat; scape and three first flagellar segments yellow, the following ones gradually darker, distal half of antennae brown. *Thorax* blackish-brown, its pubescence yellowish; the shoulders and sides of notum somewhat orange and with grey pruinosity; disc of notum moderately shining. *Abdomen* shining black; corners of posterior border of segments slightly orange. *Legs* yellowish; tip of posterior coxae, base and tip of posterior femora blackish. *Wings* with brown markings; one on distal third which is more intensive on anterior border, one on base of Rs and last one below Cu_2; these two last ones rather faint; tip of Sc past base of Rs; stem of M not much longer than *r-m;* fCu a little before that of M. Halteres yellow.

Length of body and wing 4 mm.

Type: Cass (Tonn.) 30th Nov., 1924, in Canterbury Mus. coll.

Paratopotype: one male.

17. Genus TAXICNEMIS nov.

This genus, which is in some ways closely connected to *Aneura,* is characterized by the roundish head with unindented, scantily pubescent eyes; lateral ocelli either touching eyes or well separated from them, the middle ocellus very small and sometimes placed forward; one pair of ocellar bristles and two pairs of vertical. Prothorax with one strong pronotal and one propleural bristle, also sometimes 1-2 prosternal; Sc short, interrupted, Cu_1 also interrupted at the base. Tibial setae arranged in lines; a strong hind tibial comb; claws strong and toothed.

Genotype *T. hirta* (Marsh.).

KEY TO SPECIES.

1. Mesonotum nearly all black or with lateral black stripes	2.
Mesonotum nearly all orange, with only a black spot above the wing root	*flava* Edw.
2. Disc of mesonotum entirely black; macrotrichia scanty in anal field	*hirta* (Marsh.)
Mesonotum with two black lateral bands only; macrotrichia fairly numerous in anal field	*hirta*, var. *bivittata* Edw.

1. **Taxicnemis hirta** (Marsh.). (Fig. 48.)

Marshall, *Trans. N.Z. Inst.*, 28, p. 283, pl. 9, fig. 5 (*Sciophila*).

Besides Mt. Torlesse, the type's locality, this species is known from Waiho, 17th Jan., 1922 and 7th Feb., 1922 (Tonnoir).

2. **T. hirta** var. n. **bivittata** Edw.

♂ Resembles the type, the structure of the hypopygium, etc., being identical, but differs as follows:—Palpi clear yellow. Mesonotum more brightly shining, middle stripe light brown or obsolete though lateral stripes are deep black. Tibial bristles longer and stronger, those on middle tibiae quite twice as long as tibial diameter. Macrotrichia fairly numerous over the whole anal field. Knob of halteres mainly blackish.

Type: Ohakune (Harris) Feb., 1924, in Brit. Mus. coll.

Paratypes: *idem,* Dec., 1922 and Mar., 1924.

In one specimen R_4 is absent on one wing.

3. **Taxicnemis flava** n. sp. Edw. (Figs. 195-197.)

♂ *Head* much as in *T. hirta,* except that the vertex is rather strongly grey-dusted; lateral ocelli actually in contact with eyes and the small median ocellus is placed distinctly in front of laterals. *Thorax* scarcely shining, uniformly bright ochreous, except for a small blackish spot immediately above and in front of root of wings. Bristles all black; no strong prosternal bristles; a short row of small acrostrichals. *Abdomen* uniformly ochreous; hypopygium very different from that of *T. hirta;* structure as figured. *Legs* ochreous, tibiae and tarsi dark, bristles black; chaetotaxy as in *T. hirta.* Spurs orange at base only, the rest dark brownish. *Wings* almost as in *T. hirta,* but R_4 more oblique, making an angle of only about 30° with R_5. Macrotrichia almost covering the anal field. Halteres ochreous.

Length of body, 3½ mm., wing, 4 mm.

Type: Mt. Grey (J. W. Campbell), 23rd Feb., 1924, in Brit. Mus. coll.; Nelson, 6th Nov., 1923 (Tonn.).

18. Genus ANEURA Marsh.

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 287.

A typical New Zealand genus.

One species *A. filiformis* differs from all the others by having the fine tibial setae arranged in definite rows, a character which in other groups of Sciophilinae may be considered of tribal rank. However, here this character does not seem even to justify the erection of a new genus as *A. filiformis* in all other respects is very much similar to the other species of Aneura.

Genotype: *A. boletinoides* Marsh.

Key to Species.

1. Tibial setae arranged in definite straight rows	1. *filiformis* Tonn.
Tibial setae irregularly arranged	2.
2. Mesonotum shining black or with two black bands above the wing base cubital fork rather long; halteres and palpi yellow	2. *nitida* Tonn.
Mesonotum not shining black nor with lateral black stripes; cubital fork shorter, its base far beyond the base of Rs	3.
3. Front tibiae with three rows of four bristles; thorax largely dark; halteres yellow; R_4 present	3. *fusca* Tonn.
Front tibiae with at most two or three small bristles; thorax mainly ochreous	4.
4. Posterior margin of abdominal tergites pale	5.
Posterior margin of abdominal tergites dark	8.
5. Mesonotum with three thin dark stripes converging posteriorly	4. *appendiculata* Tonn.
Mesonotum not distinctly striped	6.
6. Wings with fine microtrichia all over the surface; first segment of front tarsi slightly longer than the tibia; R_4 present	5. *fagi* Marsh.
Wings without microtrichia except at extreme base; first segment of front tarsi distinctly shorter than the tibia; R_4 absent	7.
7. Sc reaching far beyond the base of Rs; M_1 distinct throughout	6. *bispinosa* Edw.
Sc reaching only a short distance beyond the base of Rs; M_1 faint except at base	7. *longipalpis* Tonn.
8. First segment of front tarsi shorter than the tibia; Sc ending far beyond the base of Rs; R_4 generally present	8. *longicauda* Tonn.
First segment of front tarsi longer than the tibia; Sc ending a shorter distance beyond the base of Rs; R_4 absent	9.
9. Branches of median fork abbreviated	9. *defecta* Edw.
Branches of median fork reaching the margin	10.
10. Male claspers densely hairy at base	10. *boletinoides* Marsh.
Male claspers with a small patch of bristles at base	11. *pallida* Edw.

1. **Aneura filiformis** n. sp. Tonn. (Fig. 204.)

♂ *Head* brown, palpi black; scape and base of third antennal segment yellow, the rest of flagellum dark; antennae not quite as long as abdomen, segments of flagellum cylindrical, and little distinct from

each other. *Thorax* dull orange with long black bristles on notum. *Abdomen* entirely dark, very thin, densely pubescent; hypopygium lighter, claspers much elongated with internal spine near base (fig. 204). *Legs* yellowish, the fine tibial setae arranged in regular straight rows, tibial bristles extremely short. *Wings* subhyaline; Sc reaching costa before base of Rs; stem of M a little shorter than its fork; fCu about midway between fM and *r-m*. Halteres with darkish knob.

♀ Similar to male; *abdomen* less slender, terminal lamellae dark.

Length of body 5 mm., wing 3½ mm.

Type: Waiho (Tonnoir), 17th Jan., 1922, in Cawthron Inst. coll.

Allotype: Ohakune (Tonn.) 8th Mar., 1923.

Paratype: Wellington, 10th Mar., 1923 (Tonn.).

Specimen in Brit. Mus.: Ohakune (Harris).

2. **Aneura nitida** n. sp. Tonn.

♂ *Head* brown, mouth-parts yellow as well as base of antennae, including third joint, the rest of flagellum brown. Antennae not quite as long as abdomen, segments quite distinct from each other. *Thorax:* pronotum and greater part of pleurae yellow,, mesonotum shining black, bristles in double rows of acrostical and dorso-central; postnotum, hypotergites and lower part of sternopleurites brown. *Abdomen* with first segment all orange, three following ones extensively orange at base, their posterior border and median dorsal line black, last abdominal segment black. Hypopygium with black claspers and yellow ventral lamellae. *Legs* yellowish orange. *Wings* subhyaline, unmarked; R_4 present forming a little cell; tip Sc at level of middle of this little cell. Stem of M much longer than its fork; fork of Cu about at the level of the tip of Sc. Halteres yellow.

♀ Similar to male but somewhat lighter; the 2-3 first segments of the flagellum yellow; all abdominal segments except the last visible one with orange markings at base. Terminal lamellae orange.

Length of body and wing 3 mm.

Type: Lake Brunner (Tonnoir) 4th Feb., 1922, in Cawthron Inst. coll.

Allotype: Ohakune (Tonnoir) 8th Mar., 1923.

Paratypes: Hilltop, 15th Jan., 1925; Aniseed Valley, 1st Dec., 1923; Nelson, 23rd Nov., 1923.

Specimens in Brit. Mus.: Blackball (Campbell); Ohakune (Harris).

In the males the shoulders are sometimes more or less extensively yellow whereas in the females the notum may be entirely orange with exception of a black stripe above each wing's base.

3. **Aneura fusca** n. sp. Tonn. (Fig. 203.)

♂ *Head* brown, mouth-parts yellowish; antennae as long as ⅔ of abdomen, brown with base somewhat lighter. *Thorax* dull brown, sides more greyish; dorso-central and acrostical bristles arranged in double rows. *Abdomen* brown somewhat shining, posterior part of middle segments dull orange chiefly on lateral corners. Hypopygium dark. *Legs* yellowish. *Wings* subhyaline; R_4 present forming a little cell about five times as long as broad; tip of Sc past middle of this cell; stem of M as long as M_1; fCu at level of tip of Sc. Halteres yellowish.

♀ Similar to male.

Length of body 3 mm., wing 3½ mm.

Type: Mt. Arthur (Tonnoir), 20th Dec., 1921, in Cawthron Inst. coll.

Allotype Governors Bay (Tapley), in Brit. Mus. coll.

Paratypes: Mt. Arthur, Dec., 1921; Otira, 7th Feb., 1922.

4. **Aneura appendiculata** n. sp. Tonn. (Fig. 202.)

♂ *Head* brown, palpi elongate, thin, and brownish; antennae brown; cape and basal half of third segment yellow, whole antenna as long as five first abdominal segments together; segments of flagellum cylindrical, a little distinct from each other. *Thorax* ochreous, mesonotum with three thin, brown, stripes converging posteriorly and placed along lines of dorsocentral and acrostical bristles. Scutellum, postnotum and hypotergites obscure. *Abdomen* brown, posterior margin of segment 2-5 yellow and more extensively so on sides. Hypopygium orange, its three pairs of rather long and hairy appendages black. *Legs* dark yellow. *Wings* subhyaline; M rather faint; Sc past the base of Rs; stem of M about one-fifth longer than M_1; fCu under middle of stem of M. Halteres yellow.

♀ Similar to male; lateral margin of mesonotum narrowly, but rather conspicuously, dark; all abdominal tergites margined with yellow posteriorly; lamellae black.

Length of body and wing 3½ mm.; female 4½ mm.

Type: Maitai Valley, Nelson (Tonnoir), 17th Mar., 1922, in Cawthron Inst. coll.

Allotype: Ohakune (Harris) Nov., 1922, in Brit. Mus. coll.

5. **Aneura fagi** (Marsh.). (Fig. 199.)

Marshall, *Trans N.Z. Inst.*, 28, 1896, p. 282, pl. 10, fig. 1 *(Sciophila)*.

This species is not uncommon; hypopygium as shown in fig. 199.

Waiho, 30th Nov., 1922; Otira, 9th Feb., 1922; Kaitouna, 19th Feb., 1922; Nelson, 20th Oct., 1923; Cass, Nov., Dec., and Feb., 1924-25; Ohakune (Harris); Mt. Grey (Campbell.

6. **Aneura bispinosa** n. sp. Edw. (Figs. 50, 201.)

Very similar to *A. longipalpis* but distinctly larger; *thorax* and coxae of a somewhat more orange tint; male hypopygium different, claspers bearing a very stout spine on inner face somewhat before middle; wing-veins stouter; costa rather shorter, reaching only one-fifth of the distance from R_5 to M_1; Sc longer, ending far beyond base of Rs; branches of M brownish and equally distinct throughout, whereas in *A. longipalpis* M_1 is always abruptly fainter on the outer two-thirds.

Length of body, 4½-5½ mm.; wing, 4-4½ mm.

Type ♂: Raetihi Hill, 3000 ft. (T. R. Harris), Nov., 1923, in Brit. Mus. coll.; Ohakune (T. R. Harris); paratypes 1 ♂ 8 ♀, Nelson (A. Tonnoir); 1 ♀, 15th Dec., 1921.

This species is very distinct from all other members of the genus except *A. longipalpis* by the absence of microtrichia on the wings.

7. **Aneura longipalpis** n. sp. Tonn. (Fig. 200.)

♂ *Head* brown, palpi long and dark; antennae as long as the four first abdominal segments together; scape yellow; flagellum dark. *Thorax* obscure orange; mesonotum with very faint brownish wide stripes, postnotum and hypotergites also somewhat darkened. *Abdomen* with posterior margin of segments 1-4 yellow, the rest brown. Hypopygium mostly dark, structure as shown in fig. 200. *Wings* subhyaline; tip of Sc placed distinctly after origin of Rs; stem of M about as long as M_1; distal half of M_2 and the whole of M_3 faint; fCu at the level of the third fourth of the stem of M. Halteres with dark knobs.

♀ Similar to male; *thorax* brighter orange; all the abdominal segments with yellow hind-margin, the last visible segment completely yellow; terminal lamellae deep black. Fork of Cu more toward base of wing.

Length of body, 4 mm., wing $3\frac{1}{2}$ mm.

Type: Mt. Arthur, Nelson (Tonnoir) 26th Dec., 1921, in Cawthron Inst. coll.

Allotype: *idem*, 24th Dec., 1921.

Paratypes; *idem* and from Lake Brunner, 4th Feb., 1922.

Specimens in Brit. Mus.: Ohakune; West Coast, South Is. (Harris).

The position of fCu is somewhat variable.

8. **Aneura longicauda** n. sp. Tonn. (Figs. 51, 206.)

♂ *Head* brown, palpi long dark; antennae as long as six first abdominal segments; scape yellow, flagellum dark. *Thorax* orange. *Abdomen* brownish orange, posterior margin of segments dark, the last segments completely dark. Hypopygium mostly orange, structure as in fig 206. *Legs* yellow. *Wings* subhyaline; tip of Sc much after origin of Rs; R_4 absent in type but generally present; stem of M somewhat longer than its fork which is rather faint; fCu below middle of stem of M. Halteres with somewhat obscure knobs.

♀ Similar to male: sixth abdominal segment dark only at tip; lamellae black, but last sternite brownish-orange.

Length of body and wing $3\frac{1}{2}$ mm.

Type: Ohakune (Tonnoir), 8th Mar., 1923, in Cawthron Inst. coll.

Allotype: Ohakune (Harris) Apl., 1923, in Brit. Mus. coll.

Paratypes: *idem* and Lake Brunner (Tonnoir) 5th Feb., 1922.

9. **Aneura defecta** n. sp. Edw.

♀ Closely resembles *A. boletinoides* and *A. pallida,* but rather larger; anal lamellae somewhat conical, not parallel-sided at base as in *A. boletinoides;* Sc rather longer, extending beyond base of Rs for a distance equal to more than half distance between Sc_2 and base of Rs; branches of median fork both abbreviated, not reaching margin (in *A. boletinoides* both branches, though faint, alway distinctly reach the margin).

Length of body, 4·2 mm.; wing, 4·2 mm.

Type: Ohakune (T. R. Harris), Dec., 1922, in Brit. Mus. coll.

10. **Aneura boletinoides** Marsh. (Figs. 52, 202.)
Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 288, pl. 10, fig. 5, pl. 13, fig 12.

One complete female specimen only exists in Prof. Marshall's collection and has been selected as the type; it corresponds very well with the description. The three other specimens under that label have lost their abdomen and seem to belong to *A. fagi.*

A male that corresponds well to the description has been chosen as allotype, the structure of its hypopygium is given in fig. 202.

Allotype: 30th Jan., 1922, Waiho (Tonnoir), in Cant. Mus. coll.; Ohakune (Harris).

In some examples of this species the knob of the halteres is pale, in others it is dark.

11. **Aneura pallida** n. sp. Edw. (Fig. 205.)

♂ Closely resembles *A. boletinoides,* no external differences being apparent unless *thorax* is of a paler yellow colour. Hypopygium also similar in type, but different in many details; the whole organ is relatively shorter; ninth tergite relatively larger, and slightly emarginate apically; erect hairs facing inwards at base of lower claspers more bristly and confined to a small patch; the upper clasper darker and without long hairs (fig. 205).

Type: Ohakune (T. R. Harris), Oct.-Nov., 1922, in Brit. Mus. coll.

19. Genus PARVICELLULA Marsh.

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 284.

A genus peculiar to New Zealand. The small cell is absent in some of the species.

Key to Species.

1. Knob of Halteres dark; antennae entirely dark	1. *obscura* Tonn.
Halteres completely yellow; antennae more or less yellow at base	2.
2. Wings with a median dark fascia	2. *fascipennis* Edw.
Wings unmarked or only with the tip darkened	3.
3. Tip of wings distinctly darkened	3. *apicalis* Tonn.
Wings completely hyaline or with an inconspicuous shadow near the tip of R_1	4.
4. Palpi yellow	4. *gracilis* Tonn.
Palpi dark	5.
5. Middle and hind coxae brown	6.
All the coxae yellow	8.
6. Base of antennae more extensively yellow; mesonotum more ochreous; ventral clasper of hypopygium not much curved	5. *nigricoxa* Tonn.
Colouration different; ventral clasper of hypopygium very much curved	7.
7. Claspers with a little bristle about mid-length	7. *subhamata* Tonn.
Claspers without bristles	6. *hamata* Edw.
8. Mesonotum usually ochreous	8. *ruficoxa* Tonn.
Mesonotum dark brown except on the sides	9. *triangula* Marsh.

1. **Parvicellula obscura** n. sp. Tonn.

♀ *Head* and appendages brown except scape; which is obscure yellow; lateral ocelli rather distant from eye-margin. *Thorax* entirely dull brownish-black. *Abdomen* shining black; terminal lamellae yellow. Pubescence of the whole body brown. *Legs:* posterior coxae and hind femora blackish, the rest brownish-yellow. *Wing* subhyaline, tip of Sc not quite reaching base of R_4. Halteres with base of stem yellow, the rest black.

♂ Similar to female; antennae still darker at base; hypopygium lost.

Length of body 2 mm.; wing 2¼ mm.

Type: Aniseed Valley (Tonnoir), 1st Dec., 1923, in Cawthron Inst. coll.

Allotype: Nelson (Tonnoir), 18th Oct., 1923.

2. **Parvicellula fascipennis** n. sp. Edw. (Fig. 54.)

♀ *Head* black. Lateral ocelli practically touching eyes. Antennae with scape brownish ochreous, flagellum black, segment about half as long again as broad; palpi black. *Thorax* dull brownish ochreous above, without darker stripes; pleurae and postnotum dark brown. *Abdomen* shining black; anal lamellae yellow. *Legs* ochreous, four posterior coxae blackish. *Wings* with ground-colour faintly yellowish; a rather broad complete dark brown band across middle; venation normal. Halteres ochreous.

Length of body, 3 mm.; wing, 3½ mm.

Type: Ohakune (Harris), in Brit. Mus. coll.

Paratypes: ♀ ♀ *idem* and Aniseed Valley (Tonnoir), 1st Dec., 1923.

3. **Parvicellula apicalis** n. sp. Tonn. (Fig. 213.)

♂ *Head* mouth-parts and antennae brown, scape somewhat lighter, chiefly on internal side; lateral ocelli distant from eye margin from about their half diameter. *Thorax* completely dull blackish. *Abdomen* shining black; pubescence of body yellowish-brown. Hypopygium as in fig. 213. *Legs* yellow, tip of coxae 2 and 3 brown. *Wing* with a brown apical marking from a little past tip of R_1 and more intensive on anterior border. Tip of Sc in front of R_4; stem of M and base of M_3 very faint. Halteres yellow.

Length of body 2½ mm.; wing, 3 mm.

♀ Similar to male.

Type: Lake Brunner (Tonnoir) 4th Mar., 1922, in Cawthron Inst. coll.

Allotype: Waiho (Tonn.), 27th Jan., 1922.

4. **Parvicellula gracilis** n. sp. Tonn. (Fig. 211.)

♂ *Head* brown, palpi and base of antennae including basal half of third joint orange; lateral ocelli distinctly distant from eye-margin. *Thorax* ochreous-brown. *Abdomen* shining black. Pubescence of body yellowish. Hypopygium brown, rather large, its structure as in fig. 211. *Legs* yellow, tip of hind coxae dark. *Wings* subhyaline; tip of Sc at level of R_4; base of M_3 scarcely distinct; stem of M equal to a quarter of M_1. Halteres yellow.

Length of body and wing, 2½ mm.
Type: Reefton, 13th Jan., 1922 (Tonn.), in Cawthron Inst. coll.
Paratypes: all ♂ ♂, Cass 27th Nov., 1924 and 18th Feb., 1925; Aniseed Valley, 1st Dec., 1925.

5. **Parvicellula nigricoxa** n. sp. Tonn. (Fig. 210.)
♂ *Head* brown, palpi brown, base of antennae including the third and fourth segment yellow. *Thorax* brown, the mesonotum ochreous, dull. *Abdomen* shining black; pubescence of body yellow. Hypopygium rather large, black, its structure as in fig. 210. *Legs* yellow, coxae 2 and 3 blackish. *Wings* subhyaline unmarked; tip of Sc a little distance past R_4. Stem of M equal to ⅛ of M_1. Halteres yellow.
Length of body 2½ mm.; wing 3 mm.
Type: Dun Mt. (Tonn.), 15th Jan., 1922, in Cawthron Inst. coll.

6. **Parvicellula hamata** n. sp. Edw. (Figs. 208, 209.)
Closely resembles *P. nigricoxa* Tonn., differing mainly if not solely in male hypopygium; lateral appendages of the ninth tergite are longer and more hairy, and ventral claspers are longer, more twisted, and much more strongly hooked.
Type and allotype Ohakune (Harris) Dec., 1922, in Brit. Mus. coll.

7. **Parvicellula subhamata** n. sp. Tonn. (Fig. 215.)
Similar to *P. hamata* Edw. differing only in hypopygium; ventral claspers are not so hooked and are provided with a very small bristle about mid-length; inner appendage of ninth tergite bears a few very elongated scales.
Female similar to male; colouration of the *thorax* a little lighter.
Type and allotype: Otira (Tonn.), 6th Feb., 1922, in Cawthron Inst. coll.

8. **Parvicellula ruficoxa** n. sp. Tonn. (Figs. 53, 214.)
♂ *Head* and mouth-parts brown; base of antennae including basal half of the third segment yellowish; lateral ocelli nearly touching eye-margin. *Thorax* brown, mesonotum ochreous, pleurae darker. *Abdomen* shining black; pubescence of body yellow. Hypopygium as in fig. 214. *Legs* completely yellow. *Wings* with a very faint shadow about the tip of Rs; Sc ending in front of R_4. Halteres yellow.
♀ Similar to male, *thorax* lighter, base of palpi yellowish.
Length of body and wing 2½ mm.
Type: Kaikoura (Tonn.), 23rd Feb., 1922, in Cawthron Inst. coll.
Allotype: *idem*.
Paratypes: Khandallah, 2nd Nov., 1921; Nelson, 3rd Apl., 1922, 15th Dec., 1921; Te Aroha, 1st Mar., 1923; Christchurch, Nov.-Jan.; Akaroa, 10th Dec., 1924 (Tonn.); Governors Bay (Tapley); Ohakune (Harris).

9. **Parvicellula triangula** Marsh. (Fig. 212.)
Marshall, *Trans. N.Z. Inst.*, 28, p, 285.
♂ *Head* and mouth-parts brown; base of antennae rather extensively yellow up to fifth or sixth segment, which are, however, darker than those of base; lateral ocelli nearly touching the eye-margins.

Thorax rather dark brown, with shoulders, sides of mesonotum, and scutellum ochreous. *Abdomen* shining black. Pubescence of body yellow. Hypopygium blackish, its structure as in fig. 212. *Legs* entirely yellow. *Wings* subhyaline, unmarked; tip of Sc in front of base of R_4; stem of M equal to $\frac{1}{4}$ of M_1. Halteres yellow.

Length of body and wing, $2\frac{1}{2}$ mm.

Nelson, 14th Nov., 1923; Kaikoura, 22nd Feb., 1922; Waiho, 19th Jan., 1922; Christchurch, 16th Feb., 1922; Cass, 18th Feb., 1925 (Tonn.); Governors Bay (Tapley); White Rock (Campbell); Ohakune (Harris); Mt. Grey (Campbell).

The small cell may be absent in some specimens.

20. Genus PHTHINIA Winn.

This genus is characterized by the extreme slenderness of the legs and abdomen; by the fork of the cubitus being distinctly distal to that of the media and by the peculiar twist of Cu_2. It is known from Europe and North America. There is only one New Zealand species which seems rather well spread although not at all common.

Phthinia longiventris n. sp. Tonn. (Fig. 59.)

♂ *Head* brown, palpi yellow, scape a little lighter coloured than brown flagellum, the segments of which are scarcely distinct from each other; antennae about as long as the four first abdominal segments. *Thorax* rather shining, brown, yellowish around wing-base, and anapisternite; bristles black. *Abdomen* dull black with basal third of segments 3 to 5 whitish-yellow, base of the following segments more narrowly pale; hypopygium yellowish, of rather simple structure. *Legs* very elongate, yellowish-brown, hind pair darker, all coxae yellowish with dark tip; median tibiae dilated on basal third and provided there with a dorsal groove. *Wings* subhyaline, unmarked, macrotrichiae very numerous but less so in anal region; costa nearly reaching wing-tip; stem of M equal to half of *r-m;* M_1 undulated; Cu_2 nearly perpendicular on wing-margin. Halteres with very long stem base of which is yellowish, the rest and the knob dark.

♀ Similar to male; *abdomen* darker, only the base of the middle segments of a somewhat dull yellow, the rest brown.

Length of body, 6 mm., wing, $4\frac{1}{2}$ mm.

Type: Wiltons Bush, Wellington (Tonn.) 2nd Dec., 1921, in Cawthron Inst.

Allotype: *Idem.*

Paratypes: Mt. Arthur, 24th Dec., 1921; Nelson, 6th and 28th Nov., 1923; Aniseed Valley, 1st-4th Dec., 1923 (Tonn.).

Specimens in Brit. Mus.: Queenstown (Curtis).

21. Genus APHELOMERA Skuse.

The venation of this genus is remarkably reduced, the media being simple and detached at the base, whereas the base of the anterior branch of Cu is also missing. The *thorax* is extremely arched and the *abdomen* slender. So far this genus is only recorded from Australia and New Zealand.

KEY TO SPECIES.

1. Thorax dull ochreous; mesonotal bristles black; costa reaching the tip of wing	1. *opaca* Tonn.
Thorax mainly dark	2.
2. Posterior coxae with dark tips; costa reaching wing tip	2. *majuscula* Edw.
Coxae completely yellow; costa not quite reaching the wing tip	3.
3. Mesonotal bristles black, hair short and black	4.
Mesonotal bristle and hairs yellowish	5.
4. Thorax very much arched; antennae long, middle segments of the flagellum about four times as long as broad; hypopygium orange	4. *elongata* Tonn.
Thorax less arched; antennae relatively shorter, middle segments of the flagellum about three times as long as broad; hypopygium dark	3. *longicauda* Edw.
5. Thorax dark brown, scarcely shining; dorsocentral and lateral bristles markedly longer than the shorter hairs	7. *marshalli* Edw.
Thorax mainly shining black, shoulders ochreous; mesonotal hairs long, the dorsocentral bristles hardly longer	6.
6. Prothorax yellowish; wings distinctly darkened on the apical fourth	5. *forcipata* Edw.
Prothorax dark; wings not darkened apically	6. *skusei* Marsh.

1. **Aphelomera opaca** n. sp. Tonn. (Fig. 265.)

♂ *Head* brown, palpi brownish, scape dark ochreous, flagellum brown its segments three to four times longer than broad, the whole antenna as long as height of thorax plus coxae. *Thorax* dull ochreous with black hairs and bristles. *Abdomen* shining brown, very thin and elongated; hypopygium as in fig. 265. *Legs* yellowish. *Wings* clear; macrotrichia fairly numerous; tip of R_1 distinctly further than tip of M_3; Sc ending a little before base of Rs. Halteres with yellowish stem and black knob.

Length of body, 2¼ mm., wing, 2½ mm.

Type: Queenstown (Curtiss) 1st Feb., 1922, in Canterbury Mus.

Paratype: Nelson, May, 1923 (Tonn.)

Specimens in Brit. Mus.: Ohakune (Harris).

2. **Aphelomera majuscula** n. sp. Edw.

♀ *Head* dull black. Scape of antennae rather dark brown (flagellum missing). Palpi yellowish, darkened at base. *Thorax* entirely blackish-brown, scarcely shining. Mesonotal bristles and hair all black, dorsocentral bristles rather short and hardly differentiated from the rather coarse bristly hair spread over whole surface. *Abdomen* black, black-haired, anal lamellae obscurely reddish. *Legs* ochreous; tarsi darkened; the four posterior coxae blackish on nearly the apical half; hind femora narrowly black at tip. *Wings* rather smoky, lighter towards base; in shape rather longer, relatively to their breadth, than in the other species. Sc ending above base of Rs; R_1 unusually long, ending well beyond the level of the tip of the short free vein M_3. R_5 slightly curved down at tip; costa just reaching wing-tip and ending at one-third of distance from R_5 to M_1. Halteres with ochreous stem and black knob.

Length of body, 3½ mm.; wing, 4 mm.

Type: Ben Lomond, 2,500 ft. (L. Curtis), 7th Mar., 1923, in Brit. Mus. coll.; Ohakune, 8th Mar., 1923 (Tonn.).

This specimen is distinctly larger than any others examined, and in view of the differences in venation and in the colour of the coxae there can be no doubt that it represents a distinct species.

3. **Aphelomera longicauda** n. sp. Edw. (Figs. 222-224.)

♂ *Head* black; palpi and scape yellow; flagellum black, segments a little over twice as long as broad, with pubescence nearly twice as long as diameter. *Thorax* shining black, only humeral angles ochreous, bristles and hair blackish, rather short, dorsocentral bristles little developed. *Abdomen* black, hypopygium entirely dark; claspers very long and flat, with a few blunt spines along their ventral margin. *Legs* ochreous. *Wings* slightly greyish, tip scarcely darker; macrotrichia small but fairly numerous, erect as usual. Sc ending well before base of R_5; R_1 ending just before tip of M_3; R_5 almost straight; costa reaching about a quarter of distance from R_5 to M_1. Halteres with ochreous stem and black knob.

Length of body, about 2½ mm.; wing, 2½ mm.

Type: Ohakune (T. R. Harris), May-July, 1923, in Brit. Mus. coll. Nelson (Tonn.), 6th Nov., 1922; 9th and 18th Oct., 1923; Akaroa, 9th Dec., 1924.

4. **Aphelomera elongata** n. sp. Tonn. (Fig. 221.)

♂ *Head* brown, scape and palpi yellow, flagellum brown with a long pubescence, its segments over three times as long as broad, the whole antenna somewhat longer than height of thorax plus coxae. *Thorax* brown shining, shoulders ochreous, bristles and hairs black, dorsocentral bristles not very distinct from hairs. *Abdomen* rather shining blackish-brown; hypopygium yellow, its structure as in fig. 221. *Legs* yellowish. *Wings* clear, macrotrichia rather numerous; tip of Sc a little before base of Rs in front of that of Cu_1; costa nearly reaching wing-tip. Halteres brown, base of stem yellowish.

♀ Similar to male, only a little larger (2½ mm.). Antennae relatively shorter.

Length of body and wing, 2 mm.

Type: Nelson (Tonn.), 15th Dec., 1921, in Cawthron Inst. coll.

Allotype: Maitai Valley (Nelson), 17th Mar., 1922.

Paratype: Nihotupu (Tonn.), 24th Feb., 1923.

5. **Aphelomera forcipata** n. sp. Edw. (Figs. 217-218.)

♂ *Head* black; palpi and scape yellow; flagellum black, segments over twice as long as broad, pubescence a little longer than diameter of segments. *Thorax* shining black, but prothorax yellow. Mesonotal hair and bristles rather long and all yellow as in *A. skusei*. *Abdomen* black. Hypopygium large, with long curved yellow claspers constructed somewhat as in *A. marshalli*. *Wings* quite clear on basal three-fourths, apical fourth rather dark grey. Sc ending just before base of Rs; R_1 ending just beyond tip of M_3; R_5 almost straight; costa reaching about one-fourth of the distance from R_5 to M_1. Halteres with ochreous stem and black knob.

Length of body, 3 mm.; wing, 3 mm.

Type: Ohakune (T. R. Harris), Sept., 1922, in Brit. Mus. coll.

Paratype ♂, Mar., 1924.

6. Aphelomera skusei Marsh. (Figs. 60, 226.)
Marshall, *Trans. N.Z. Inst.*, 18, 1896, p. 296, pl. 11, fig. 4.

Two species were included in Prof. Marshall's collection under that name. One has been chosen as type; the male hypopygium is represented in fig. 226.

This species is not uncommon; we have it from: Governors Bay (Tapley); Dunedin (Fenwick); Ohakune (Harris); Nelson (Tonn.), 1st and 14th Nov., 1923.

7. Aphelomera marshalli n. sp. Edw. (Figs. 219, 220.)

♂ *Head* blackish; scape and palpi yellow; flagellum black, segments over twice as long as broad, with pubescence as long as diameter. *Thorax* dark brown, scarcely shining, mesonotum somewhat dusted over with grey. Bristles and hair all yellowish; dorsocentral bristles rather long, hair short. *Abdomen* blackish. Hypopygium with small yellowish claspers of complicated structure, as figured. *Legs* ochreous. *Wings* quite clear; macrotrichia very small and few in number. Sc ending before base of Rs; R_1 ending just before tip of M_3; costa reaching less than a quarter of the distance from R_5 to M_1; R_5 almost straight. Halteres with ochreous stem and black knob.

Length of body, about 2 mm.; wing, 2·2 mm.

Type ♂ : Mt. Torlesse (Prof. P. Marshall), was one of the four specimens on which the description of *A. skusei* was based; it is smaller than *A. skusei*, with the thorax much less shining, and with a very different hypopygium. In Brit. Mus. coll.

22. Genus NEOTRIZYGIA nov.

Three ocelli in triangle, the lateral ones far removed from eye-margin; eyes and palpi normal; antennae 2 + 14 segmented, segments of flagellum as wide as long, densely pubescent. Prothorax bristly, postnotum, hypotergites anepisternum and subalar knob hairy.

Sc long ending in R_1 past base of Rs which is short and transverse; *r-m* in line with second segment of Rs. M unbranched; Cu_1 incomplete at base; A represented only by an incomplete row of macrotrichia. Micro and macrotrichia present simultaneously on the whole wing-membrane. Fascies of the body like *Aphelomera,* posterior coxae much elongated; *Abdomen* thin, seventh segment visible. Tibiae 2 with a few bristles, tibiae 3 with two rows of rather weak bristles.

It differs from *Trizygia* to which it is closely related in the thoracic chaetotaxy, by Sc ending in R_1, and in *r-m* being much longer and in line with Rs, by the seventh abdominal segment being visible and the hypopygium not pedunculate.

Genotype *Neotrizygia obscura* n. sp.

Neotrizygia obscura n. sp. Tonn. (Fig. 61.)

♂ *Head* black, antennae and palpi brown, scape somewhat lighter coloured. *Thorax* black, rather shining with blackish bristles and hairs, dorso-central bristle not much longer than the hairs. *Abdomen* shining black with black pubescence. Hypopygium black, small, of rather simple structure. *Legs:* front pair and median coxae yellowish,

the rest brownish. *Wings* clear, venation as in fig. 61; macrotrichia very numerous. Halteres black with yellowish stem.

Length of body and wing, 2½ mm.

Type: Cass (Tonn.), Feb., 1925, in Canterbury Museum coll.

23. Genus MORGANIELLA nov.

Antennae 2 + 14, segments of the flagellum as wide as long. Ocelli in a row, the lateral ones far removed from the eye-margin, median one very small. Palpi four segmented, the second segment somewhat incrassate, the two last ones subequal. Anepisternites, subalar knobs, hypotergites and postnotum hairy. *Abdomen* with the seventh segment scarcely visible. *Legs* with tibial spurs normal, some rows of moderately long bristles on posterior tibiae, empodium present. *Wings* covered all over with macrotrichia, microtrichia present only on the tip and round the posterior border. Sc long, reaching the costa well after the base of Rs; Sc_2 reaching R_1 also well after the base of Rs; *r-m* in line with Rs and equal to the stem of M which is short; Cu_1 incomplete at base; A rather strong but suddenly interrupted about mid-length.

Genotype *M. fusca* n. sp.

Morganiella fusca n. sp. Tonn. (Fig. 74.)

♂ *Head* black, palpi yellow; scape somewhat lighter than the brown flagellum. *Thorax* dull brown, only mesonotum shining. *Abdomen* and hypopygium shining black. Pubescence of the whole body yellowish-brown. *Legs:* coxae brown with exception of distal half of front ones; femora and tibiae yellowish, tip of posterior femora dark, tarsi darker. *Wings* subhyaline, venation as in fig. 74. Halteres yellow.

Length of body, 2½ mm., wing, 2¾ mm.

Type: Lake Brunner (Tonn.), 3rd Feb., 1922, in Cawthron Inst. coll.

Paratype: Aniseed Valley, Nelson (Tonn.), 1st Dec., 1923.

24. Genus SYNAPHA Mg.

The New Zealand representatives of this genus agree well with the European species, differing only in the mesonotum being provided with fewer bristles which are, however, more strongly developed. This genus is found also in North America.

KEY TO SPECIES.

1.	Wings with some dark markings	2. *apicalis* Tonn.
	Wings without markings	2.
2.	Abdomen with pale markings	3.
	Abdomen entirely brown	4.
3.	Mesonotum with darker stripes; vein M not faint	3. *claripennis* Tonn.
	Mesonotum ochreous without dark stripes; M faint	5. *pulchella* Tonn.
4.	Thorax ochreous yellow	5.
	Thorax dark greyish brown	6.

5. Palpi brown; hypopygium large, yellow .... 1. *gracilis* Tonn.
Palpi with the two first segments yellow; hypopygium small, brownish .... 4. *similis* Tonn.
6. Palpi completely yellow; knob of halteres brownish; brownish species .... 6. *cawthroni* Tonn.
Palpi completely or partly dark; only the base of the halteres knob dark; greyish species .... 7. *parva* Edw.

1. **Synapha gracilis** n. sp. Tonn. (Fig. 229.)

♂ *Head* greyish-brown, palpi brownish, scape yellow, flagellum brown. *Thorax* ochreous-yellow with long black bristles on the notum. *Abdomen* cylindrical elongate, dull brown with dark pubescence. Hypopygium yellow, swollen, its structure as in fig. 229. *Legs* yellow. *Wings* hyaline; Sc short not even reaching base of *r-m;* M faint, its stem equal to half of M_1; fork of Cu nearly under that of M. Halteres with yellow stem and black knob.

Length of body and wing, 3½ mm.

Type: Khandallah, 3rd Nov., 1921 (Tonn.), in Cawthron Inst. coll.

2. **Synapha apicalis** n. sp. Tonn. (Fig. 55.)

♀ *Head* greyish-brown, mouth-parts yellowish; antennae brown, scape scarcely lighter. *Thorax* dull brownish-grey, pronotum and some parts near wing-base yellowish. *Abdomen* dull brown with very narrow hind border to segments 3 to 5; terminal lamellae orange. *Legs* yellow. *Wings* with apical third and a space under form of Cu smoky; M and Cu faint; stem of M equal to half of M_3; fork of Cu a little more proximal than that of M. Halteres yellowish.

Length of body, 4 mm.; wing, 4½ mm.

Type: Mt. Arthur (Tonn.), 26th Dec., 1921, in Cawthron Inst. coll.

Paratypes: *idem*, 22nd and 24th Dec.

Specimens in Brit. Mus.: Ohakune (Harris); Waitati, Dunedin (M. N. Watt).

3. **Synapha claripennis** n. sp. Tonn.

♀ *Head* greyish-brown; mouth-parts, scape and third segments yellow, the rest of antennae brown. *Thorax* brownish-grey; pronotum ochreous, mesonotum with three darker stripes. *Abdomen* brown, more or less shining; posterior border of segments 2 to 5 yellow, terminal lamellae brown. *Legs* yellowish. *Wings* hyaline. Sc not quite reaching proximal end of *r-m;* M not so faint as in other species, its stem equal to half of M_1; fork of Cu somewhat more proximal than that of M. Halteres yellowish.

Length of body, 3½ mm.; wing, 4 mm.

Type: Mt. Arthur (Tonn.), 24th Dec., 1921, in Cawthron Inst. coll.

4. **Synapha similis** n. sp. Tonn. (Fig. 230.)

♂ *Head* brown; mouth-parts with exception of two last palpal segments yellow; scape and base of third segment yellow, the rest of antennae brown. *Thorax* ochreous-yellow as in *gracilis*. *Abdomen* rather shining, brown, without pale markings. Hypopygium rather

small, ochreous-brown. *Legs* yellow. *Wings* as in *gracilis*. Halteres with yellow stem and dark knob.

Length of body and wing, 3½ mm.

Type: Nelson (Tonn.), 15th Dec., 1921.

5. **Synapha pulchella** n. sp. Tonn. (Fig. 227.)

♂ *Head* greyish-brown, proboscis and base of palpi yellowish, the rest brown; scape yellow, flagellum brown. *Thorax* ochreous-brown somewhat lighter near shoulders. *Abdomen* brown, more or less shining, base of segments 2 to 5 yellow, chiefly on sides. Hypopygium mostly yellowish, its structure as in fig. 227. *Legs* yellow. *Wings* hyaline, unmarked; Sc short not quite reaching proximal end of *r-m*; M faint, its stem equal to half of M_1; fork of Cu placed before that of M. Halteres yellow.

♀ Similar to male, the base of abdominal segment less yellow on the sides.

Length of body and wings, 3 mm.

Type: Wiltons Bush (Tonn.), 2nd Dec., 1921, in Cawthron Inst. coll.

Allotype: Cass (Tonn.), Feb., 1925.

Paratypes: Cass, Nov., Dec., Feb., Aniseed Valley, Nelson, 1st Dec., 1923.

6. **Synapha cawthroni** n. sp. Tonn. (Fig. 228.)

♂ *Head* brown; scape and mouth-parts yellow. *Thorax* greyish-brown, dull on mesonotum; pronotum and parts of pleurae near wing-base ochreous; hairs on mesonotum yellow, bristles black. *Abdomen* more or less shining-brown with dark pubescence, venter ochreous as well as claspers of hypopygium, its structure as in fig. 228. *Legs* yellow. *Wings* as in *gracilis*. Knob of halteres brownish.

Length of body, 3½ mm; wing, 3 mm.

Type: Nelson (Tonn.), 28th Nov., 1923, in Cawthron Inst. coll.

7. **Synapha parva** n. sp. Edw. (Fig. 56.)

♀ *Head* dull blackish; antennae and palpi almost entirely blackish, only the second antennal segment brown. Flagellar segments less than twice as long as broad. *Thorax* entirely dull dark grey; mesonotal bristles all black; four long ones in dorsocentral rows; acrostichal bristles all very small. Scutellum with the usual two long bristles placed very wide apart. *Abdomen* blackish, somewhat shining, with dark hair; anal lamellae ochreous. *Legs* ochreous; tarsi and spurs dark. *Wings* quite clear; venation as in *S. gracilis;* M and Cu_1 faint. Halteres ochreous, only base of knob dark.

Length of body, 2½ mm.; wing, 2·8.

Type: Queenstown waterworks (L. Curtis), 8th Dec., 1922, in Brit. Mus. coll.

♂ The whole body greyish-black; base of palpi, scape, legs, and halteres yellow. Hypopygium somewhat ochreous.

Allotype: Cass (Tonn.), 27th Nov., 1924, in Canterbury Mus. coll.

25. Genus ANOMALOMYIA Hutton.

Genus peculiar to New Zealand but closely related to the Australian *Acodicrania* Skuse. Some species have a distinct middle ocellus.

Key to Species.

1. Crossvein *r-m* as long as the last segment of R_1 and less than half the stem of M. Colouration of body and wing rather variable	1. *guttata* Hutton
r-m distinctly longer than the last segment of R_1 and longer than half the stem of M	2.
2. Wings without markings; colouration mostly orange	2. *immaculata* Edw.
Wings with distinct markings, or if not distinct then the general colouration nearly entirely black	3.
3. Body completely black including the halteres and the greater part of the legs	3. *obscura* Tonn.
Body completely black but halteres yellow; legs mostly yellowish	4. *subobscura* Tonn.
Colouration different	4.
4. Wing-tip conspicuously darkened, this dark area delineated from the rest of the membrane by a straight transverse line	7. *thompsoni* Tonn.
Wing marking different	5.
5. Base of abdomen with some orange markings	5. *basalis* Tonn.
Abdomen dark at base	6.
6. Wings with a spot or shadow in base of cell R_5	7.
No spots of shadow in cell R_5	8.
7. Wing markings rather faint; hypopygium orange at base	8. *flavicauda* Edw.
Wing markings strong; hypopygium black	6. *affinis* Tonn.
8. Costa reaching about two-thirds of the way between R_5 to M_1	9. *viatoris* Edw.
Costa not reaching half-way between R_5 and M_1	10. *minor* Marsh.

1. Anomalomyia guttata Hutton. (Figs. 66, 67.)

This abundant species seems to vary greatly in colour, both of body and wings. In the lighter specimens the mesonotal stripes are narrow and hardly darker than ground-colour; pleurae mainly ochreous, except lower part of sternopleurae; abdominal segments with broad basal ochreous bands; wings with quite small dark spots at base and in middle of cell R_5 and cell Cu_1. In the darkest specimens mesonotal stripes are blackish and fused; pleurae and abdomen all dark; tibial spurs even sometimes dark and a larger and darker spot in base of cell R_5. There is no difference in hypopygium of the lighter and darker forms. In all its varieties it may be distinguished from the other species by its venation: *r-m* as long as last section of R_1 but less than half as long as stem of median fork.

It is found nearly the whole year round all over the country from Stewart Island to Auckland district.

Type in Canterbury Museum coll. without locality.

2. Anomalomyia immaculata n. sp. Edw.

♀ *Head* orange, except for a small black spot round each ocellus. Palpi orange. Antennae short, flagellar segments not longer than

broad, orange, last 5-6 segments darkened. *Thorax* uniformly orange, mesonotum shining. *Abdomen* more brownish-ochreous (probably discoloured), entirely unmarked. *Legs* bright ochreous, only tibial spines black; middle tibiae with two equal ventral spines. *Wings* with yellowish tinge, veins hardly darker; no trace of markings. Costa reaching half way from R_5 to M_1; *r-m* not much shorter than stem of median fork; R_1 half as long as *r-m;* Cu_1 not interrupted at base; An. faint. Halteres orange.

Length of body, 4 mm.; wing, 3·7 mm.

Type: Otira (J. W. Campbell), 10th Jan., 1920, in Brit Mus. coll.

3. **Anomalomyia obscura** n. sp. Tonn. (Fig. 235b.)

♂ Completely black more or less shining, only basal $\frac{2}{3}$ of tibiae, tibial spurs and metatarsi obscure orange. Pubescence of whole body and appendages yellow. *Wings* with moderately distinct markings: spot at base of cell R_5, another darker one along distal half of R_5 and gradually merging in apical brown shadow; basal half of cell M_1 clear. Venation as in *minor*. Structure of hypopygium quite different as shown in fig. 235b. Only one ventral bristle on middle tibiae.

Length of body $2\frac{1}{2}$ mm.; wings, 3 mm.

Type: Otira (Tonn.) 9th Feb., 1922, in Cawthron Inst. coll.

4. **Anomalomyia subobscura** n. sp. Tonn.

♀ Body completely black as well as head and its appendages. *Legs* mostly yellow; coxae and all ventral face of femora blackish, tibial spurs yellow, tarsi darker towards tip; two subequal ventral bristles on middle tibiae. *Wings* with very faint markings arranged as in *obscura*. Wing-shape somewhat more elongated than in other species; tip of Sc at level of fork of Cu which is placed distinctly before base of M; *r-m* at least equal to $\frac{3}{4}$ of stem of M, branches of which are rather faint at tip.

Length of body $2\frac{1}{2}$ mm.; wing, 3 mm.

Type: Tahunanui, Nelson, on sea-beach (Tonn.), in Cawthron Inst. coll.

5. **Anomalomyia basalis** n. sp. Tonn. (Fig. 233.)

♂ *Head* brown, palpi yellowish, antennae brown, scape somewhat lighter. Mesonotum orange with two lateral black stripes and a trace of a median one, scutellum orange, rest of thorax brownish-black. *Abdomen* black, base and hind border of second segment orange; hypopygium black, its structure as in fig. 233. *Legs:* coxae yellow, femora 1 and 2 black underneath at base, hind femora black at base and apex, tarsi mostly yellow; two bristles on ventral face of middle tibiae. *Wings* with moderately conspicuous markings, a rather faint shadow near base of cell R_5, the whole apex of wing darkened and more intensively under distal part of R_5, no clear space in middle of cell M_1; *r-m* nearly equal to stem of M. Halteres yellow.

Length of body, 3 mm.; wings, 3 mm.

Type: Otira (Tonn.), 9th Feb., 1922, in Cawthron Inst. coll.

6. **Anomalomyia affinis** n. sp. Tonn. (Figs. 70, 235c.)

♂ *Head* and appendages brown, first antennal segment slightly lighter. Mesonotum dark orange with three more or less fused dark stripes on disc; the rest of thorax brown. *Abdomen* shining black; hypopygium also black, its structure as in fig. 235c, differing but slightly from the one of *flavicauda*. *Legs* mostly yellow; tip of coxae 2 and 3 black, also tip of hind femora; the two ventral bristles of middle tibiae subequal. *Wings* with a conspicuous dark spot at base of cell R_5, another one below distal part of R_5 which extends into the dark shadow of wing-tip, middle of the cell M_1 free. Halteres yellow.

♀ Similar to male, mesonotum lighter, first half of antennae more or less orange.

Length of body, 2½ mm.; wing, 3 mm.

Type: Otira (Tonn.), 8th Feb., 1922, in Cawthron Inst. coll.

Allotype: *idem.*

Paratypes: *idem.*

Sometimes the thorax is dark with exception of the shoulder and the scape is more or less orange.

7. **Anomalomyia thompsoni** n. sp. Tonn.

♀ *Head* orange, ocelli black, middle one distinct although small; palpi orange; base of antennae orange their tip darkened. *Thorax* rather bright orange. *Abdomen* shining brown, first segment and terminal lamellae orange. *Legs* orange with strong black bristles and orange tibial spurs; tip or tarsi darkened. *Wing* rather elongate, with a distinct yellow tinge, chiefly on anterior border and with apical fourth blackish, the limit between the two differently coloured areas along a straight transverse line; *r-m* not quite twice as long as last segment of R_1: fM below base of Rs. Halteres orange.

Length of body, 3 mm.; wing, 4 mm.

Type: Lake Brunner, 21st Dec., 1925 (Tonn.), in Canterbury Mus. coll.

8. **Anomalomyia flavicauda** n. sp. Edw. (Fig. 235.)

♂ Very similar to *A. minor,* differing as follows:—Middle tibiae with the two ventral spines subequal in length. Hypopygium yellow except towards tip; claspers differently shaped, with short blunt spines all over inner face, none of them, however, forming combs as they do in *A. minor;* aedoeagus also quite different in structure. Costa reaching more than half way from R_5 to M_1; fCu more distinctly before base of *r-m;* Cu_1 narrowly interrupted at base. A small but distinct spot filling base of cell R_5; a larger dark cloud crossing this cell beyond middle, but leaving tip of wing clear; cell M_1 slightly darkened at base and beyond middle; Cu_1 distinctly dark-bordered above as well as below; An. stronger and darker.

Type: Ohakune (T. R. Harris), Apl., 1923, in Brit. Mus. coll.

9. **Anomaloyia viatoris** n. sp. Edw. (Figs. 68, 234.)

♂ *Head* black, with yellow bristles. Palpi and antennae entirely black; first flagellar segment about three times as long as broad, the remainder fully as long as broad. *Thorax* entirely blackish, slightly shining, bristles all yellow. *Abdomen,* black, except for the ochreous hypo-

pygium. Claspers somewhat triangular, with a number of small spines and four or five very stout ones facing inwards; ventral hooks smaller than in the other species. *Legs* dull ochreous, tarsi darkened; front femora with blackish stripe beneath running the whole length; middle femora with a similar stripe on basal half; hind femora rather narrowly black at tip. Tibial spurs ochreous, spines black; second ventral spine on mid tibiae short. *Wings* with a slight yellowish tinge, tip darkened, though not conspicuously; a rather more distinct dark stripe below Cu_2. Costa reaching about two-thirds of way from R_5 to M_1; *r-m* about two-thirds as long as stem of median fork; R_1 quite two-thirds as long as *r-m*; Cu_1 narrowly interrupted at base; An. faint. Halteres ochreous.

Length of body, 3½ mm.; wing, 4 mm.

Type: McKinnon Pass (C. L. Edwards); and one other ♂ caught on the snow, 3rd Apl., 1923, in Brit. Mus. coll.

10. **Anomalomyia minor** Marsh. (Figs. 69, 232.)

Marshall, *Trans N.Z. Inst.*, 28, 1896, p. 295 *(Anomala)*.

Characteristic of this species is the short costa, which extends less than half way from R_5 to M_1; *r-m* is two-thirds as long as median fork; last segment of R_1 barely half as long as *r-m*. There is no distinct spot in base of cell R_5. The second ventral bristle on middle tibiae is short or absent.

Governors Bay (Tapley), Nelson, 14th Oct., 1923; Hilltop, 16th Feb., 1925; Christchurch, 24th Nov., 1924; Akaroa, 11th Dec., 1924 (Tonn.).

26. Genus PARADOXA Marsh.

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 290.

A genus peculiar to New Zealand, closely related to *Cycloneura* but characterized mainly by the branched media.

Paradoxa fusca Marsh. (Fig. 71.)

Marshall *l.c.*, p. 290.

Only the male has been described by Marshall; the female has exceedingly short antennae, not longer than head; colouration of body and legs as in male; base of M_3 completely missing.

Allotype: Aniseed Valley (Tonn.), 4th Dec., 1923.

27. Genus CYCLONEURA Marsh.

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 289.

As understood by Marshall this genus is characterized by the presence of a small basal cell formed by the base of Cu_2 and A; however in some closely-related forms this little cell is not complete. The diagnosis of the genus should, therefore, be established as follows: Sc short, ending free, M simple; Cu_2 sinuous, vein A ending in its elbow and forming thus a little basal cell, or ending free at some distance before the elbow of Cu_2, the little cell not being then completely closed.

Genotype: *C. flava* Marsh.

This genus is apparenty confined to New Zealand.

The antennae and palpi were not seen by Marshall; the first ones are about as long as the thorax in the male and noticeably shorter in the female in which the flagellar segments are about as long as wide only; the palpi are rather short with the segments subequal to each other.

Key to Species.

1. Vein A ending free, not forming a basal cell with Cu_2 ...... 2. *aberrans* Tonn.
   Vein A ending in Cu_2 with which it forms a little basal cell ...... 2.
2. Front tarsi with last segment dilated in male; front tibae with dorsal bristles at the tip only; last section of R_1 rather longer than *r-m* ...... 3. *triangulata* Tonn.
   Front tarsi normal in male; front tibiae with small dorsal bristles usually present on about the distal third; R_1 shorter ...... 1. *flava* Marsh.

Cycloneura flava Marsh. (Figs. 63, 236.)
Marshall *l.c.* p. 289.

A series of specimens that we refer to this species shows a great deal of variation in colouring; some are completely dark including base of antennae, others have shoulders and base of antennae more or less pale, whereas a few have the mesonotum more or less ferrugineous and antennae extensively yellowish; females in general lighter coloured than males, some having thorax and abdomen ochreous and wings yellowish.

Only the type, a female, was known to Marshall; a male has been chosen as allotype, its hypopygium is represented in Fig. 236.

Type: Port Hill, Christchurch, coll. Marshall.

Allotype: Cass, 27th Nov., 1924 (Tonn.).

Other specimens: Otira, 7th Feb., 1922; Mt. Arthur, 27th Dec., 1921; Dun Mt., 5th Jan., 1922; Cass, 27th Nov., 1924 and Feb., 1925; Hilltop, 15th Jan., 1925 (Tonn.)

Cycloneura aberrans n. sp. Tonn. (Fig. 64.)

♂ Completely dull black with exception of front and middle legs which are brownish-yellow, hind tibiae also somewhat lighter. *Wings* with a rather extensive dark brown spot on anterior border which is more intensive under distal half of Rs; the rest of membrane more or less brownish but tip clear. Vein A not fused at end with Cu and not forming the typical cell of the genus; all other details of venation as in *C. flava.*

♀ Differs from male by antennae relatively much shorter; antennae and palpi entirely yellow; front legs much lighter coloured. Anal lamellae yellow. Wing markings somewhat more intensive but clear apical fascia larger.

Length of body, 2 mm.; wing, 2½ mm.

Type: Nelson (Tonn.), 14th Nov., 1923, in Cawthron Inst. coll.

Paratype: Cass (Tonn.), 30th Nov., 1924.

Paratypes: Nelson, 18th Nov., 1923; Aniseed Valley, 1st Dec., 1923; Dun Mt., 27th Oct., 1922; Cass, 30th Nov., 1924.

Cycloneura triangulata n. sp. Tonn. (Fig. 237.)

♂ *Head* dark brown, antennae with first five segments yellow, the following ones gradually darker, flagellar segments about twice as long as wide. *Thorax*: pronotum orange; mesonotum partly ochreous especially round shoulders, the rest brownish; *Abdomen* brown; hypopygium dark, claspers triangular, orange. *Legs* yellowish; front tarsi dilated at tip, empodium very large. Venation as in *C. flava;* last section of R_1 comparatively longer; anterior part of membrane yellowish with a brown roundish spot under extremity of Rs. Halteres with black knob.

Length of body, 2 mm.; wing, 2½ mm.

Type: Mt. Arthur (Tonn.), 24th Dec., 1921, in Cawthron Inst. coll.

Specimen in Brit. Mus.; West Coast, South Is. (Harris).

28. Genus PARACYCLONEURA nov.

This genus is closely related to *Cycloneura;* head similar with antennae inserted rather low and eyes rather approximated on the face; ocelli in a line, lateral ones touching the eye-margin, median one small; a few postorbital bristles present. Palpi four segmented and short. Pronotum and mesonotum with some long bristles but the rest of thorax completely bare. *Thorax* much arched; *abdomen* moderately long with a large hypopygium. *Legs* normal, tibiae 2 and 3 with rows of moderately long bristles. Venation: Sc short, incomplete: last section of R_1 about equal to *r-m* which is oblique; M unbranched anterior branch of Cu free at the base; posterior branch of Cu regularly curved; A incomplete and weak.

Genotype: *P. apicalis* n. sp.

Paracycloneura apicalis n. sp. Tonn. (Figs. 73, 238.)

♂ *Head* brown, palpi and base of antennae yellow; pronotum and mesonotum orange with black bristles, the rest of thorax darker. *Abdomen* and large swollen hypopygium brown. *Legs* yellow, tip of femora 2 and 3 and of tibiae 3 dark. *Wings* with a preapical transverse dark fascia which is more intensive near anterior border, wing-tip more or less clear.

♀ Antennae more extensively yellow at base; *abdomen* lighter brown, but hind legs darker.

Length of body, 2 mm.; wings, 2½ mm.

Type: Waiho (Tonn.), 21st Jan., 1922, in Cawthron Inst. coll.

Allotype: *idem,* 17th Jan., 1922.

Paratypes: Nelson, 14th Nov., 1923; Otira, 9th Feb., 1922; Cass, Dec., 1924.

A male paratype from Cass has the wing-tip completely brownish like the disc.

29. Genus CAWTHRONIA nov.

Related to *Anomalomyia* from which it is distinguished as far as the venation is concerned by the branch of Cu_1 free at the base which is brought far back towards the wing base like in *Paradoxa.*

Head more elongate than in *Anomalomyia;* the three ocelli present, removed far back on vertex, the middle one smaller and

placed a little more forward. Antennae short (in female), a little longer than head, segments of flagellum much wider than long, compressed. Palpi normal. No special bristles on head, also not on thorax with exception of those on pronotum and scutellum; mesonotum with an evenly spread pubescence. *Thorax* not much arched. *Abdomen* rather short and broad, with only six visible segments (♀). *Legs* short, front coxae and all femora rather dilated; front tibiae with row of spinules on dorsal side; posterior tibiae with some rows of small and of large bristles, all more or less dorsal, the large ones not much longer than tibial diameter. *Wings* with some scattered macrotrichia in anal field and near posterior border. Venation: Costa reaching beyond tip of R_5; Sc rather long ending in costa; Sc_2 absent; *r-m* shorter or subequal to last section of R_1 or to stem of M; Cu_1 free at base; Cu_2 undulating; A also undulating but divergent from Cu and incomplete.

This genus comes near *Clastobasis* Skuse, from which it differs mainly in venation by the complete Sc, the costa produced beyond the tip of R_5 and by the peculiar twist of Cu_2 which is similar to that of *Cycloneura* and allied forms.

Genotype *C. nigra* n. sp.

Cawthronia nigra n. sp. Tonn. (Fig. 72.)

♀ Entirely black, rather dull, pubescence of body brownish-black; all appendages black with exception of anterior legs which are a shade lighter on femora and tibiae. The whole wing brownish, this colouration much more intensive on anterior border but not at tip.

Length of body, 2¼ mm.; wing, 2¾ mm.

Type: Nelson (Tonn.), 1st Nov., 1923, in Cawthron Inst. coll.

Paratype: *idem*, 14th Nov., 1923.

In the paratype Sc is distinctly shorter, not reaching base of Rs and *r-m* is nearly equal to last section of R_1. There is otherwise no other difference which would justify its being considered as belonging to another species. They have been both obtained in the same spot on the Cawthron Institute grounds.

30. Genus SIGMOLEIA, nov.

Head of the usual form. Three ocelli, placed almost in a straight line far back near nape, laterals remote from eyes. Palpi short, apparently consisting of only two segments. Labium small and little produced. Mesonotum strongly arched, bristles little developed. Anepisternites bare; hypopleurites hairy. *Abdomen* rather short and stout, with six visible segments. *Legs* rather short; front and middle tibiae without bristles, hind tibiae with only one row, placed on the other side; no hind tibial comb; tibial setae irregularly arranged; claws rather large but simple; empodium small. *Wings* without macrotrichia on membrane; microtrichia irregularly arranged. Sc very short and ending free; Costa reaching far beyond R_5; *r-m* short, rather oblique; median fork not much longer than its stem; M_1 strongly sinuous, cell M_1 much widened on outer half; Cu_2 almost at right angles to C_1 at base, then sharply bent, An meeting it at bend and forming a closed cell.

Genotype: *S. melanoxantha*, n. sp.

Although there can be little doubt that this genus is to be placed in the Leiini, some of its characters, such as the absence of bristles from the middle tibiae, are so peculiar that it stands quite apart from the other genera of the tribe. The general appearance rather suggests *Anomalomyia*, but the condition of the cubital and anal veins, also the rudimentary subcosta, indicate a nearer connection with *Paradoxa* and *Cycloneura*.

Sigmoleia melanoxantha n. sp. Edw. (Fig. 65.)

♀ *Head* black, somewhat shining, with short black bristles. Antennae with first three segments yellow, also bases of next five, the rest black; flagellar segments about half as long as broad. Palpi black. *Thorax* entirely black, somewhat shining, bristles all black. Scutellum with four rather short marginal bristles and some smaller hairs. *Abdomen* nearly bare, yellow, posterior margins of each of tergites 2-5 and the whole of segments 6 and 7 black; anal lamellae ochreous; sixth segment rather small. *Legs* with the front coxae and the hind femora entirely black; the four posterior coxae yellow; front and middle femora and all tarsi dark brownish-ochreous; hind tibiae black at tip; spurs black, on posterior legs outer spur about half as long as inner. About 10 bristles on hind tibia, the longest rather longer than diameter of segment. *Wings* with a slight yellow tinge, near the apical half brown, darker towards costa; a dark spot in base of cell R_5; upper half of costal cell dark; R_1 about six times as long as *r-m*. Halteres with yellow stem and black knob.

Length of body, 3 mm.; wing, 3·2 mm.

♂ Antennae less extensively yellow at base, flagellar segments about as broad as long. *Head* and *thorax* dull black. *Abdomen* less extensively yellow, flat, seventh segment not visible. Hypopygium of the pincers type, black.

Type: Ohakune (T. R. Harris), May-July, 1923, in Brit. Mus. coll.

Allotype: Lake Brunner, 16th Dec., 1925 (Tonn.).

31. Genus TRICHOTERGA nov.

This genus comes very near *Tetragoneura* from which it differs mainly by the presence of a few pleurotergal bristles, a character common with *Megaphtolmidia*, but there is no hind tibial comb as in this last genus.

The venation differs little if at all from that of most of the New Zealand *Tetragoneura* but the hypopygium has a rather complicated structure quite different from the simple type of *Tetragoneura*.

This genus is closely related to *Sciarella* Meun. by its venation; it is, however, impossible to ascertain if the other characters would justify considering *Trichoterga* as congeneric with this fossil form.

Genotype: *T. monticola* n. sp.

Trichoterga monticola n. sp. Tonn. (Figs. 78, 244.)

♂ *Head* brown; palpi rather small, brown; antennae brown, segments of the flagellum about twice as long as wide. *Thorax* brown,

mesonotum dull, more or less greyish with dark pubescence and long bristles on disc and sides leaving some bare stripes. *Abdomen* brown, more or less shining with six visible segments. Hypopygium half-hidden under sixth tergite, its structure as in fig. 244. *Legs* yellow. *Wings* clear; *r-m* not quite half as long as R_1; stem of M two and a half times as long as *r-m;* fork of Cu placed a little over that of M; A distinct but interrupted at level of fCu. Halteres yellowish.

Length of body and wing, 2½ mm.

Type: Otira (Tonn.), 8th Feb., 1922, in Cawthron Inst. coll.

Paratype: Nelson (Tonn.), 20th Apl. 1922.

Specimens in Brit. Mus.: Ohakune (Harris).

This species seems to be very variable in colour. Several specimens from Ohakune have the *thorax* nearly all yellowish, mesonotum scarcely darker, but halteres with the knob more or less completely blackish instead of yellow, yet the hypopygium is typical. On the other hand some dark specimens from the same locality have the pleurae almost as dark as the notum, which is dark brown and not striped, but the halteres are yellow..

T. monticola, var. **incisurata** nov. Edw.

Scape clear yellow; mesonotum with three dark stripes along lines of dorsocentral and acrostical bristles; posterior margin of abdominal segments rather broadly and conspicuously yellow.

Length of wing, 4½ mm.

Type: Mt. Grey (Campbell), in Brit. Mus. coll.

Paratype: Ohakune (Harris).

32. Genus TETRAGONEURA Winn.

In this genus of nearly world-wide distribution, the small cell is not always present, even in all the specimens of the same species.

Key to Species.

1. Vein R_4 usually present	2.
Vein R_4 usually absent	7.
2. Mesonotum with rather evenly spread pubescence leaving no bare stripes	3.
Mesonotum with bare spaces between the stripes of pubescence and bristles	4.
3. Halteres with black knob	1. *opaca* Tonn.
Halteres entirely yellow	2. *fusca* Tonn.
4. Front tibiae with about ten dorsal spines in the distal half	5. *spinipes* Edw.
No such spines	5.
5. Halteres yellow	6.
Halteres mostly black	7. *proxima* Tonn.
6. Mesonotum dark ochreous with three blackish stripes converging behind; base of antennae extensively yellow	3. *nigra* Marsh.
Mesonotum entirely dark; stem of M not twice as long as *r-m*	4. *minima* Tonn.
7. Abdomen with posterior margin of segments ochreous; base of Rs rather oblique	6. *obliqua* Edw.
Abdomen entirely brown	8.
8. Halteres completely or partly dark	9.
Halteres yellow	12.

9. Second segment of palpi provided with a terminal extension as long and broad as the segment itself	9. *distincta* Tonn.
Palpi normal	10.
10. Base of antennae, palpi and coxae yellowish	11. *minuta* Tonn.
Base of antennae, palpi and greater part of coxae dark	11.
11. Tergal plate of hypopygium longer than broad and provided with four spines on its distal edge	8. *venusta* Tonn.
Tergal plate of hypopygium not longer than broad and without spines	10. *obscura* Tonn.
12. All the bristles of the thorax yellow, tibial spurs yellow	12. *ultima* Tonn.
Bristles of thorax and tibial spurs black	13.
13. Mesonotum greyish with four narrow darker stripes	13. *rufipes* Tonn.
Mesonotum without darker stripes	14. *flexa* Edw.

1. **Tetragoneura opaca** n. sp. Tonn. (Fig. 240.)

♂ *Head* brown; palpi small, yellow; second segment of antennae yellowish, flagellum with the segments as long as broad. *Thorax* greyish-black, mesonotum with short yellowish-brown pubescence evenly distributed and leaving no bare stripes, long bristles on disc greyish black, mesonotum with short yellowish-brown pubescence Hypopygium as in fig. 240. *Legs* yellowish-brown, posterior coxae darker; tip of hind femora and tibiae as well as tibial spurs black. *Wings* clear; R_4 present; *r-m* nearly equal to last section of R_1; stem of M nearly twice as long as *r-m;* fCu under R_4; A distinct but short. Halteres with yellow stem and black knob.

Length of body, $1\frac{3}{4}$ mm.; wing, 2 mm.

Type: Aniseed Valley, Nelson (Philpott), 12th Mar., 1922, in Cawthron Inst. coll.

2. **Tetragoneura fusca** n. sp. Tonn. (Figs. 76, 253.)

♂ *Head* brown; mouth parts yellow, palpi rather long, basal half of antennae yellow, flagellar segments scarcely longer than broad. *Thorax* black, disc of mesonotum ferrugineous, its pubescence small, dark and evenly distributed leaving no bare stripes, no conspicuous bristles except on sides where they are very long. *Abdomen,* first segment partly yellowish, the rest black with dark pubescence. Hypopygium as in fig. 253. *Legs* yellow, apical fourth of hind femora black; tibal spurs reddish. *Wings* subhyaline; R_4 present; *r-m* equal to last section of R_1; stem af M half as long again as *r-m;* fCu under base of Rs. Halteres yellow.

♀ Similar to male, antennae more extensively yellow, venter yellow except distally, first abdominal segment completely yellow.

Length of body, 2 mm.; wing, $2\frac{1}{2}$ mm.

Type: Lake Brunner (Tonn.), 3rd Feb., 1922, in Cawthron Inst. coll.

Allotype: *idem.*

Paratypes: Waiho, 28th Jan., 1922; Nihotupu, 24th Feb., 1923 (Tonn.); Ohakune (Harris).

3. **Tetragoneura nigra** Marsh. (Fig. 252.)

Marshall, *Trans N.Z. Inst.,* 28, 1896, p. 286, pl. 13, fig. 10-11.

The hypopygium of the type is shown in fig. 252.

♂ *Head* brown; palpi yellow, rather long; first half of antennae yellow; segments of flagellum longer than broad. *Thorax* brown;

mesonotum dark ochreous with three darker stripes converging behind and placed along rows of acrostical and dorsocentral bristles and hairs between which there are some bare stripes. Pubescence brownish.

Wings clear; R_4 present; *r-m* subequal to R_1; stem of M one-half time longer than *r-m* and not faint; fCu placed before the base of Rs; A distinct but interrupted. Halteres yellow.

Besides Lincoln, which is the type's locality, this species has been collected at: Waiho, 19th Jan., 1922; and Nelson, 28th Nov., 1923 (Tonn.)

4. **Tetragoneura minima** n. sp. Tonn. (Fig. 250.)

♂ *Head* black; base of antennae and palpi yellowish. *Thorax* black, mesonotum rather shining with bare lines and black bristles on disc. *Abdomen* blackish, base of venter yellow. Pubescence of body dark. *Legs* yellowish, tip of hind femora, of posterior tibiae and tarsi darker; only one spur present on middle tibiae. *Wings* subhyaline; R_4 present; R_1 and R_5 nearly touching each other along the little cell which is therefore exceedingly narrow; last section of R_1 larger than *r-m;* stem of M not faint and twice as long as *r-m*; fCu below base of Rs; A distinct. Halteres yellow.

Length of body and wing, 2 mm.

Type: Lake Brunner, 2nd Feb., 1922 (Tonn.), in Cawthron Inst. coll.

5. **Tetragoneura spinipes** n. sp. Edw. (Figs. 77, 242.)

♂ *Head* black, ocelli in a flattened triangle. Antennae black, except for second segment and base of third, which are ochreous; first few flagellar segments about half as long again as broad, the rest gradually more elongate, pubescence almost as long as diameter. Palpi yellow. *Thorax* dull dark brown, bristles dark. Three strong pronotal bristles. Narrow bare lines between acrostichal and dorso-central series and between the latter and sides of mesonotum. Scutellum with two long bristles. *Abdomen* entirely black. Hypopygium large; ninth tergite with two little rectangular projections; claspers broad on basal third, then suddenly narrowed, the end portion slender and nearly bare. *Legs* ochreous; tarsi, tibial spurs, and tips of femora and tibiae black. Front tibiae with a group of about ten short black spines on dorsal surface of outer half. Middle tibiae somewhat swollen near base with an oval sensory area on dorsal surface. Last segment of front tarsi broad, with greatly enlarged cushion-like empodium. *Wings* clear on basal two-thirds; outer third rather distinctly darkened. Sc very short; R_1 about half as long again as *r-m;* R_4 present, the small cell nearly three times as long as broad; costa reaching about four-fifths of distance from R_5 to M_1. Base of cubital fork approximately below middle of *r-m*. An. reaching base of cubital fork, rather close to and parallel with Cu. Halteres ochreous.

♀ Antennae mainly ochreous, somewhat darkened apically; more slender and much shorter than in ♂, segments hardly longer than broad. Mesonotum lighter than in ♂. *Abdomen* with broad yellow basal bands on each of tergites 2-4, the whole venter also yellow.

Front tibiae spinose as in ♂, but middle tibiae simple, as are also front tarsi.

Length of body, 3 mm.; wing, 3·2 mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes 2 ♂ 2 ♀, Nov.-Dec., 1922.

This species seems very distinct by the spiny front tibiae. In spite of the striking differences between the two sexes there can be little doubt that all the specimens belong to one species.

6. **Tetragoneura obliqua** n. sp. Edw. (Fig. 249.)

♂ *Head* black. Antennae entirely dark, rather slender, flagellar segments, except first two or three, distinctly over twice as long as broad, pubescence shorter than diameter. Palpi very long, yellow. *Thorax* dark brown, slightly shining, slightly and uniformly grey-dusted. Bristles yellow; four or five pronotal; outer pair of scutellar bristles not much smaller than inner. Mesonotum with usual bare lines. *Abdomen* brown, pale-haired, posterior margins of tergites ochreous. Hypopygium moderately large; anal segment much more developed than in most of the other species; claspers flattened and irregularly bilobed at tip; ninth sternite with forked median appendage. *Legs* ochreous; tarsi darkened; spurs yellow; all femora dark brown at base, and hind pair also at tip. Front empodia not enlarged; front tibiae without spines; mid tibiae simple. *Wings* nearly clear, tip not darkened. Sc moderately long and ending in R; R_1 slightly longer than *r-m;* R_4 absent; base of Rs oblique and rather longer than in most of the genus; costa reaching about three-fifths of distance from R_5 to M_1; fCu below base of *r-m;* An reaching level of fCu, distinctly divergent from Cu. Halteres yellow.

Length of body, 3·2 mm.; wing, 3·2 mm.

Type: Sumner, Christchurch (J. W. Campbell); Jan., 1923, in Brit. Mus. coll.

This species is well-distinguished by the oblique Rs and Sc ending in R, also by the unusual form of the hypopygium.

7. **Tetragoneura proxima** n. sp. Tonn. (Fig. 241.)

♂ *Head* with its appendages brown; palpi small, scape slightly lighter, segments of flagellum longer than broad. *Thorax* blackish-brown, mesonotum dull, somewhat greyish, its disc with some bare stripes and long black bristles. Pubescence brownish. *Abdomen* brown with dark pubescence. Hypopygium as in fig. 241. *Legs* yellowish, tip of hind coxae and femora dark; tibial spurs black; only one spur on middle tibiae. *Wings* clear; R_4 present; last section of R_1 equal to *r-m*, stem of M faint, nearly twice as long as *r-m;* fCu under R_4; A nearly entirely absent. Halteres black, stem somewhat lighter at base.

Length of body and wing, 2½ mm.

Type: Mt. Arthur (Tonn)., 27th Dec., 1921, in Cawthron Inst. coll.

8. **Tetragoneura venusta** n. sp. Tonn. (Fig. 248.)

♂ *Head* greyish-brown; palpi rather long, brown; antennae entirely brown, segments of the flagellum about half as long as broad. *Thorax* dull brown, mesonotum with long bristles on disc and brown

hairs with bare stripes. *Abdomen* brown; hypopygium as in Fig. 248. *Legs* brownish-ochreous, coxae blackish, tibial spurs black. *Wings* clear: R_4 missing; last section of R_1 equal to *r-m;* stem of M somewhat faint and subequal to *r-m;* fCu a little before base of Rs; A distinct but incomplete. Halteres blackish.

Length of body and wing, 2½ mm.

Type: Otira, 7th Mar., 1922 (Tonn.), in Cawthron Inst. coll.

9. **Tetragoneura distincta** n. sp. Tonn. (Fig. 246.)

♂ *Head* brown; ocelli in triangle, some rather long bristles on vertex; antennae entirely brown, rather long, segments of flagellum about twice as long as broad and with short but distinct pedicel, second segment of scape with very long dorsal bristles. Palpi dark, rather long and of peculiar structure: first segment very small, second large and strong with an external terminal extention as long and broad as the segment itself, third segment club-shaped, fourth cylindrical. *Thorax* rather dull brown, mesonotum with long bristles on disc and very narrow bare stripes; pubescence brown. *Abdomen* brown with yellowish pubescence. Hypopygium structure as in Fig. 246. *Legs* brownish-ochreous, coxae black, hind femora brown. *Wings* clear; *r-m* equal to half of last section of R_1; R_4 absent; stem of M not very faint and about twice as long as *r-m*; fCu a little before base of Rs; A distinct on its first half. Halteres brown.

Length of body, 3 mm.; wing, 3¼ mm.

Type: Mt. Arthur (Tonn.), 23rd Dec., 1921, in Cawthron Inst. coll.

10. **Tetragoneura obscura** n. sp. Tonn. (Fig. 245.)

♂ *Head* greyish-brown; palpi rather long, brown; antennae entirely brown; segments of flagellum about twice as long as broad. *Thorax* brown, mesonotum with black bristles and brown hairs with bare stripes in between. *Abdomen* dull brown with darkish long pubescence. Hypopygium as in Fig. 245. Coxae blackish with exception of tip of front ones which are ochreous like the femora and tibiae, hind femora with black tips. *Wings* clear; R_4 missing; R_1 a little shorter than *r-m;* stem of M rather faint, a little longer than *r-m;* fCu under the middle of the stem of M; A distinct but interrupted. Halteres with yellow stem and dark knob.

Length of body and wing, 2½ mm.

Type: Ohakune (Tonn.), 8th Mar., 1923, in Cawthron Inst. coll.

11. **Tetragoneura minuta** n. sp. Tonn. (Fig. 251.)

♂ *Head* black; antennae brown, the scape and the rather long palpi dark ochreous; segments of flagellum longer than broad. *Thorax* blackish-brown with dark pubescence. Hypopygium as in fig. 251. *Legs* rather dark yellowish, tip of posterior femora, tibiae and tarsi darker. *Wings* subhyaline; R_4 missing; base of Rs somewhat oblique; *r-m* distinctly longer than last section of R_1; stem of M faint, very little longer than *r-m*; fCu more proximal than base of Rs. Halteres black.

Length of body and wing 2 mm.

Type: Nehotupu (Tonn.), 28th Feb., 1923, in Cawthron Inst. coll.

12. **Tetragoneura ultima** n. sp. Tonn. (Fig. 239.)

♂ *Head* dark; ocelli in a flat triangle; antennae entirely brown, segment of flagellum about twice as long as wide; palpi moderately long, ochreous. *Thorax* dull blackish-brown; disc of mesonotum with three rows of hairs and bristles with conspicuous bare spaces between them; all bristles and hairs yellow. *Abdomen* yellowish; hypopygium as in fig. 239, the claspers flat at end. *Legs*: coxae blackish with exception of front ones which are ochreous distally, rest of legs yellowish; a sensory organ on base of middle tibiae dorsally. *Wings* subhyaline; R_4 missing; *r-m* a little smaller than last section of R_1; stem of M half as long again as *r-m;* fCu distinctly before base of Rs which is a little oblique. Halteres yellow.

Length of body and wing, 2½ mm.

Type: Aniseed Valley, Nelson (Tonn.), 1st Dec., 1923, in Cawthron Inst. coll.

13. **Tetragoneura rufipes** n. sp. Tonn. (Figs. 75, 243.)

♂ *Head* blackish; mouth-parts and scape yellowish; segments of flagellum as long as broad. *Thorax* brownish-black with some greyish dusting on the mesonotum which shows four narrow darker bands where the pubescence is missing. Pubescence yellow, bristles black. *Abdomen* blackish-brown with yellowish pubescence. Hypopygium dark, structure as in fig. 243. *Legs* yellow, hind femora somewhat darker towards tip. *Wings* with a very slight shadow towards tip and posterior border; R_4 absent; R_1 a little smaller than *r-m;* stem of M a little longer than *r-m;* fCu somewhat more proximal than that of M. Halteres yellow.

♀ Similar to male.

Length of body and wing, 2 mm.

Type: Otira (Tonn.), 6th Feb., 1922, in Cawthron Inst. coll.

Allotype: Otira, 10th Feb., 1922.

Paratypes: Otira, 9th Feb., 1922; Waiho, 20th Jan., 1922 (Tonn.).

The position of fCu is somewhat variable; it is sometimes more proximal than in type.

14. **Tetragoneura flexa** n. sp. Edw. (Fig. 247.)

♂ *Head* black. Antennae with first segment brown, second and third clear yellowish, the rest black; flagellar segments about twice as long as broad, pubescence quite as long as diameter. Palpi yellow, not very long. *Thorax* dull blackish, somewhat grey-dusted; nearly denuded, the remaining hairs being yellowish; mesonotum with the usual four bare lines, middle pair very narrow. *Abdomen* blackish, first few segments lighter ventrally. Hypopygium small, constructed very much as in *T. rufipes,* but ninth tergite less triangular, and the long paramers much more slender and with tips bent rather sharply outwards at right angles to basal portion. *Legs* ochreous; tarsi and spurs dark; hind femora broadly dark brown at tips and also at base beneath. Front empodia not enlarged; middle tibiae simple. *Wings* nearly clear, tip greyish. Sc short; R_1 as long as *r-m*; costa reaching two-thirds of the distance from R_5 to M_1; R_4 absent; fCu below middle of *r-m;* An. not reaching fCu, parallel with Cu. Halteres yellow.

Length of body, 2·8 mm.; wing, 2·8 mm.

Type: Ohakune (T. R. Harris), Dec., 1922, in Brit. Mus. coll.

33. Genus ALLODIA Winn.

This cosmopolitan genus is rather scantily represented in New Zealand.

Key to Species.

1.	Wings with brownish spots and bands ...	1. *maculata* Tonn.
	Wings unmarked ...	2.
2.	Two scutellar bristles ...	3.
	Four scutellar bristles ...	4.
3.	Thorax completely orange; segments of the flagellum not longer than broad ...	2. *rufithorax* Tonn.
	Darkish species, the thorax mostly brown; segments of the flagellum one and a-half times longer than broad ...	3. *fragilis* Marsh.
4.	Three propleural bristles ...	4. *flava* Marsh.
	Two propleural bristles ...	5. *quadriseta* Edw.

1. **Allodia maculata** n. sp. Tonn. (Figs. 82, 254.)

♂ *Head* brownish; palpi long, yellow; scape yellow flagellum brown, its segments very little longer than broad, the whole antenna a little longer than head plus thorax. Mesonotum with disc brownish, the three very wide and rather faint dark bands being nearly completely fused and leaving only shoulders and sides yellow; disc of scutellum and pleurae dark. *Abdomen* brownish, posterior margin of segments yellow chiefly on sides. Hypopygium dark, structure as in fig. 254. *Legs* yellow, base of all femora and tip of hind ones dark; tarsi dark. *Wings* with dark markings: a spot on base of Rs, *r-m* and fM; a transverse zig-zag band from tip of R_1 to the tip of Cu_1; the last spot under middle of Cu_2; fork of Cu under base of *r-m*. Halteres yellow.

Length of body, 2½ mm.; wing, 2½ mm.

Type: Nelson (Tonn.), 4th Mar., 1922, in Cawthron Inst. coll.

Specimens in Brit. Mus.: Ohakune (Harris), May-July, 1923.

2. **Allodia rufithorax** n. sp. Tonn. (Fig. 259.)

♂ *Head* dark orange, more brownish on the frons; palpi rather long, yellow; scape yellow flagellum brown, its segments not longer than broad, the whole antenna not longer than head plus thorax. *Thorax* completely orange with yellow pubescence; three propleural bristles and two scutellar. *Abdomen* orange at base on two first segments, then gradually darker towards extremity and more so dorsally. Hypopygium dark with inferior styliform appendages yellow. *Legs* yellow, tibiae and tarsi darker. *Wing* hyaline; fCu placed a little before base of *r-m*. Halteres yellow.

Length of body, 2½ mm; wing, 2 mm.

Type: Otira, 9th Feb., 1922 (Tonn.), in Cawthron Inst. coll.

3. **Allodia fragilis** (Marsh.) (Figs. 81, 258.)

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 308 (*Brevicornu*).

In this species antennae of male are rather stout, flagellum segments under one and a half times as long as broad, those of female shorter and stouter at base of flagellum. Three strong propleural

bristles, sometimes a fourth weak one. Two scutellar bristles. Hypopygium as shown in fig. 258. Stem of median fork considerably longer than *r-m;* base of cubital fork below base of *r-m*; Cu_2 curved; divergent from Cu_1 apically.

Besides Lincoln, which is the type's locality, this rather common species has been collected at: Christchurch and environs from Oct. to Feb.; Nelson, 9th Sept., 1922 (Tonn.); Ohakune (Harris).

4. **Allodia flava** (Marsh.).
Marshall, *l.c.*, p. 307 (*Brevicornu*).

In this species there are three propleural and four scutellar bristles; fCu is placed before the base of *r-m.*

Besides Mt. Torlesse, the type's locality, this species is known from: Elgin Bay, L. Wakatipu (Curtis); Aniseed Valley, Nelson (Tonn.), 1st Dec., 1923.

5. **Allodia quadriseta** n. sp. Edw. (Figs. 255, 257.)

A small dark species superficially resembling *A. fragilis,* but differing as follows:—

Antennae of ♂ more slender, the flagellar segments almost twice as long as broad. Prothorax and shoulders more or less ochreous. Only two strong propleural bristles; four scutellar bristles, outer pair not much shorter than inner. Hypopygium larger and yellow, claspers very small and black. Stem of median fork scarcely longer than *r-m*; base of cubital fork well before base of *r-m*; Cu_2 almost straight, parallel with Cu_1 apically, fork much narrower than in *A. fragilis.*

Type ♂ and allotype ♀: Ohakune (T. R. Harris), Apl., 1923; in Brit. Mus. coll.

Paratype ♂ 10th Jan., 1922; Mt. Albert (A. E. Brookes), 1 ♂, 29th May, 1915.

34. Genus EXECHIA Winn.

The five New Zealand species belong to a group of the genus in which R_5 is rather distinctly curved, M_1 rather strongly sinuous, the cubital fork rather short. Cu_1 rather faint and A absent; representatives of the same group are found in Australia and in the Oriental region.

Exechia thomsoni Mill. has not been included in this list as only some parts of the type are still preserved which do not allow to distinguish this species from *E. hiemalis*; in fact it may be identical with the latter species.

KEY TO SPECIES.

1. Posterior coxae at least dark at the tip	2.
Posterior coxae completely yellow	3.
2. Posterior coxae dark at the tip only	1. *E. hiemalis* Marsh.
Posterior coxae dark on the sides	3. *E. novae-zelandiae* Tonn.
3. Palpi dark	4.
Palpi yellow	2. *E. howesi* Edw.
4. Scape yellow	4. *E. filata* Edw.
Second segment of the scape mainly dark	5. *E. biseta* Edw.

1. **Exechia hiemalis** Marsh. (Figs. 80, 265.)
Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 300, pl. 13, figs. 18-19.

This species is rather variable in size and colour; especially noteworthy is the variation of the halteres; in some specimens (Christchurch) these organs are entirely pale, or at most with the knob a little darkened at base; many of those from the North Island, however, have the knob largely or entirely blackish.

The best distinction from the four other species seems to be in the colour of the posterior coxae which have nearly always a dark brown spot at the tip. The hypopygium of the male has a simple median ventral appendage on each side of which is a large flat bare plate provided with a little hook; the long slender process of the upper clasper is angular at its base (see fig. 265).

This insect is rather common in all parts of New Zealand from July to March.

2. **Exechia howesi** n. sp. Edw. (Figs. 263, 264).

♂ Differs from *E. hiemalis* Marshall as follows:—

Third abdominal tergite with an irregular dark shade from dorsal stripe to lateral margin, but leaving posterior margin broadly ochreous. Hypopygium with mid-ventral appendage somewhat cruciform, no paired appendages associated with it; process of upper clasper not angled at base; lower clasper rather differently shaped. Hind coxae with a narrow dark line running almost the whole length of outer side; mid-coxae with traces of two dark lines. Knob of halteres blackish.

Type: Leith Valley, Dunedin (G. Howes), 1st Aug., 1922. A female from Queenstown (L. Curtis), 8th Dec., 1922, in Brit. Mus. coll, probably belong to this species.

3. **Exechia novae-zelandiae** n. sp. Tonn. (Fig 261.)

♂ *Head* brownish; face orange; palpi, scape and base of third antennal segment yellow, the rest of antennae brown. Pronotum orange; mesonotum ochreous, darker on posterior part of disc, the rest of thorax darker; besides the two long bristles on hypotergites there are a few much shorter ones and numerous small hairs. *Abdomen*: disc of segment 1 brown, the rest orange; segment 2 orange at base; segment 3 orange at base, on lateral borders, and narrowly on hind margin, but not in middle, the rest of abdomen brown. Hypopygium mostly orange, its structure according to fig. 261. *Legs* yellowish; coxae 2 and 3 dark near tip, the middle ones with a dark marking before middle, hind ones with dark streak nearly on the whole length. *Wings* as in *E. hiemalis*. Halteres yellow, base of knob darker.

Length of body, 4 mm.; wing, 3½ mm.

Type: Waiho (Tonn.), 16th Jan., 1922, in Cawthron Inst. coll.

4. **Exechia filata** n. sp. Edw. (Fig. 260.)

♂ Differs from *E. hiemalis* Marshall as follows:—

Palpi blackish except at the base. Third abdominal tergite with a dark streak along lateral margins. Hypopygium with mid-ventral appendage blackened and somewhat T-shaped, paired appendages on

each side of it small and pointed; upper clasper with the long process even more slender and thread-like, not angled at base; lower clasper stout, black, and differently shaped. Coxae marked as in *E. howesi*. Cu_1 stronger and somewhat sinuous; knob of halteres dark.

Type: Ohakune (T. R. Harris); and 1 ♀, May-Aug., 1923, in Brit. Mus. coll.

5. **Exechia biseta** n. sp. Edw. (Fig. 262.)

♂ Differs from *E. hiemalis* Marshall as follows:—

Second antennal segment mainly dark brown, though first and base of second are conspicuously pale yellow. Palpi dark brown except at base. Third abdominal tergite with nearly the apical half dark, though hind margin is narrowly pale. Hypopygium with a single long slender mid-ventral appendage; bristly ventral processes longer, truncate at tip, and there with only two long bristles rather wide apart. Process of upper clasper not angled at base; lower clasper less bifid at tip. Posterior coxae with dark cloudy markings rather more extensive than in *E. howesi*. Knob of halteres mainly blackish.

Type: Queenstown (L. Curtis), 14th Sept., 1923, in Brit. Mus. coll.

35. Genus MYCETOPHILA.

Although the species of this genus seem to be almost as numerous in New Zealand as in Europe, they do not exhibit quite so great a range of structure, and the preponderance of somewhat primitive types is very noticeable. Many of the New Zealand species have the pteropleural bristles very weak and hairlike, though numerous; this being evidently a primitive feature. On the other hand very few of the species have the tibial bristles quite so strongly developed as in the majority of European species. The hypopygium in most of the forms is of a rather uniform type, approximating closely to that of the European *M. fungorum* Deg., with long vertically placed claspers and a very deep and narrow cleft in the mid-ventral line.

KEY TO SPECIES.

1. Wings with a distinct dark band before the tip and sometimes with the tip also dark	2.
Wings with a dark central spot and dark spots or clouds at the tip of the veins	16.
Wings with a dark central spot and the apex more or less clouded, at least towards the costa	18.
Wings unmarked or with central spot only	25.
2. Middle tibiae with three or four bristles on the outer row	3.
Middle tibiae with only two bristles on the outer row	12.
3. Pteropleurites with numerous hairs but no strong bristles	4.
Pteropleurites with 2-7 distinct bristles in addition to short hairs	9.
4. Scutellum with six bristles; wing markings elaborate and extensive	1. *ornatissima* Tonn.
Scutellum with four bristles (normal)	5.

5.	Wings with cloudy dark markings, apart from the subapical band	6.
	Wings largely clear; subapical band well marked; a small well-defined spot in or near the base of cell Cu_1	8.
6.	Wings with a dark cloud close to the tip which leaves the extreme tip whitish; hind femora with a long dark stripe beneath	2. *sylvatica* Marsh.
	Wings otherwise; hind femora with a dark spot near base beneath	7.
7.	Middle tibiae with 6 dorsal bristles, wing tip hardly darkened	3. *curtisi* Edw.
	Middle tibiae with 5 dorsal bristles; wing tip distinctly darkened	4. *similis* Tonn.
8.	Mesonotum yellowish, unstriped; subapical band narrower and oblique	5. *elegans* Tonn.
	Mesonotum with three dark stripes; band on wings broad and transverse	6. *latifascia* Edw.
9.	Tibial bristles red; wings extensively dark; 6-7 pteropleural bristles	7. *howletti* Marsh.
	Tibial bristles black; wings with central spot, a subapical band and sometimes a dark tip	10.
10.	Wings with a dark tip	12. *consobrina* Tonn.
	Wings without dark tip	11.
11.	Wing band broader, reaching costa; 2-3 pteropleural bristles	9. *vulgaris* Tonn. 10. *trispinosa* Tonn.
	Wing band narrow, curved not reaching the costa, sometimes very little distinct; four pteropleural bristles	8. *virgata* Tonn.
12.	Pteropleurites with bristly hairs only (about 8); wings with an irregular but complete band across the middle	11. *elongata* Tonn.
	Pteropleurites with 2-3 distinct bristles; wings without complete middle band	13.
13.	Central wing spot small, not reaching costa	15. *minima* Edw.
	Central wing spot large and reaching costa	14.
14.	Middle tibiae with two ventral bristles	16. *submarshalli* Tonn.
	Middle tibiae with only one ventral bristle	15.
15.	Wing tip distinctly darkened	13. *marshalli* End.
	Wing tip clear	14. *pseudomarshalli* Tonn.
16.	Distinct dark spot at tip of veins, and dark clouds in cells R_5, M_1 and M_2	18. *marginepunctata* var. *ruapehuensis* Edw.
	Spots at tip of veins fainter and ill-defined; no distinct dark clouds in cell R_5, M_1 and M_2	17.
17.	Wing more than twice as long as wide	17. *marginepunctata* Tonn.
	Wing not twice as long as wide	19. *marginepunctata* var. *rotundipennis* Edw.

18.	**Body shining black; hind tibial bristles irregularly arranged, no bristle on inner side of mid tibiae**	19.
	Body not shining black; hind tibial bristles in two definite rows; 2-4 bristles on inner side of mid tibiae	21.
19.	Palpi black; wing markings faint	23. *nigripalpis* Edw.
	Palpi yellow; wing markings distinct	20.
20.	Lower part of wing tip clear	22. *nitidula* Edw.
	Whole wing tip more or less dark	20. *nitens* Tonn. 21. *subnitens* Edw.
21.	Pteropleurites with numerous hairs, two of which being rather longer than the rest	22.
	Pteropleurites with 3-4 distinct bristles; mesonotum darker; wing tip darkened	23.
22.	Mesonotum with a somewhat reddish tinge; dark wing tip sharply defined; abdominal segments with a yellow hind border	24. *phyllura* Edw.
	Mesonotum and abdomen completely brown; wing markings ill-defined	25. *subtilis* Tonn.
23.	Middle tibiae with 5 dorsal bristles; coxae and femora clear yellow	24.
	Middle tibiae with 4 dorsal bristles	29. *nigricans* Tonn.
24.	Middle tibiae with 3 external and 2 long ventral bristles; costal cell darkened except at base	26. *diffusa* Tonn.
	Middle tibiae with 2 external and 2 shorter ventral bristles; costal cell clear except at tip	27. *grisescens* Edw. 28. *lomondensis* Edw.
25.	Pteropleurites with a row of short hairs (one or two in *M. fumosa*, *M. viridis* and *M. subspinigera* a little longer than the rest but not developed into strong bristles); wings without central dark spot	26.
	Pteropleurites with 2-6 distinct bristles, often with fine hairs in addition	33.
26.	Middle tibiae with 6-7 dorsal and 4 external bristles; large long-legged species	30. *grandis* Tonn.
	Middle tibiae with 4-5 dorsal and 3 external bristles	27.
	Middle tibiae with 3-4 dorsal and 2 external bristles	28.
27.	Pleurae and coxae light green; middle tibiae with one long ventral bristle	35. *viridis* Edw.
	Thorax yellowish; middle tibiae with one ventral bristle	31. *subspinigera* Tonn.
	Thorax blackish; middle tibiae with three ventral bristles	32. *fumosa* Tonn.
28.	Body almost uniformly blackish-grey; middle tibiae without ventral bristles	29.
	Thorax ochreous or reddish-brown	30.
29.	Halteres whitish	33. *griseofusca* Tonn.
	Knob of halteres black	34. *griseofusca* var. *nigriclava* Edw.
30.	Front tarsi of male slender; anal lamellae of female orange; mid tibiae with one ventral bristle	31.
	Front tarsi of male thickened; anal lamellae of female dark brown	32.
31.	Sides of abdomen mainly blackish, except on segment 6	36. *pollicata* Edw.
	Sides of abdomen almost wholly orange	37. *luteolateralis* Edw.

32.	Middle tibiae with a ventral bristle	38. *crassitarsis* Edw.
	Middle tibiae without a ventral bristle	39. *tapleyi* Edw.
33.	Anal field of wing much enlarged and often folded over	40. *dilatata* Tonn.
	Anal field of wing normal	34.
34.	Middle tibiae normally with 4 external bristles; hind bristles irregular; central wing-spot distinct	35.
	Middle tibiae with 3 external bristles; hind tibial bristles regular	36.
	Middle tibiae with 2 external bristles; hind tibial bristles regular	40.
35.	Thorax dark; hind femora broadly black at the tip	41. *colorata* Tonn.
	Thorax mainly yellow; hind femora narrowly black at the tip	42. *clara* Tonn.
36.	Hind femora broadly black at the tip; mesonotum shining, with three dark stripes	43. *solitaria* Tonn.
	Hind femora all ochreous; mesonotum dull, not striped	37.
37.	A single small dark spot immediately in front of the scutellum, and another above the root of each wing	38.
	Thorax uniformly ochreous	39.
38.	Thorax darker; antennae not ringed	47. *filicornis* Tonn.
	Thorax ochreous; antennae more or less distinctly ringed	44. *fagi* Marsh.
39.	Wings with a conspicuous dark spot over *r-m;* middle tibiae with numerous short bristles on the inner side	45. *unispinosa* Tonn.
	Wings unspotted; middle tibiae with only two bristles on the inner side	40.
40.	Three dorsal bristles on the middle tibiae	46. *impunctata* Edw.
	Four dorsal bristles	31. *subspinigera* Tonn.
41.	Mesonotum more or less ochreous	42.
	Body almost uniformly blackish	46.
42.	Wings with a distinct central spot; scutellum and pleurae blackish	48. *furtiva* Tonn.
	Wings without central spot; scutellum ochreous	43.
43.	Antennae short in both sexes, those of the male thickened at the base	49. *conica* Tonn.
	Antennae longer, slender in both sexes	44.
44.	Middle tibiae with a ventral bristle; antennae more or less ringed	50. *integra* Tonn.
	Middle tibiae without a ventral bristle; antennae not ringed	45.
45.	Abdomen all blackish	51. *media* Tonn.
	Posterior margin of abdominal segments ochreous	52. *spinigera* Tonn.
46.	Middle tibiae with about 4 short ventral bristles; anal lamellae of female ochreous; coxae clear ochreous	47.
	Middle tibiae without ventral bristles; anal lamellae of female black; posterior coxae somewhat darkened	56. *tenebrosa* Edw.
	Middle tibiae with one long ventral bristle	53. *subtenebrosa* Tonn.
47.	Base of cubital fork below fM	55. *intermedia* Edw.
	Base of cubital fork much after fM	54. *harrisi* Edw.

1. **Mycetophila ornatissima** n. sp. Tonn. (Fig. 96.)

♂ *Head* brown, more or less orange behind eyes; antennae mostly orange on first half, the rest brown; palpi rather long, orange. *Thorax* brown somewhat shining on mesonotum; shoulders, a space above the wing-base, tip of scutellum and upper corner of sternopleurites orange; all bristles black, pubescence yellowish-brown; four propleural bristles, numerous pteropleural hairs. *Abdomen* mostly brown: segment 1 with base and hind margin orange, the following segments with mottled orange markings on sides and two narrow dorsal stripes; hypopygium brown. *Legs* yellow with numerous dark markings as follow: tip of all coxae and base of posterior ones dark, front femora with two dark ventral spots, middle femora with a basal ventral spot and a subapical wide dark ring, hind femora with basal ventral spot and distal half blackish; posterior tibiae with dorsal black spots and dark tip; middle tibiae with four dorsal, three external, two ventral and one internal bristle (sometimes 4, 4, 2, 1). *Wings* with very dark markings, as in fig. 96: middle fascia which extends to costa is united to subapical transverse band by a large bridge which leaves a small clear roundish spot in base of cell M_1 and three larger roundish spots in cells R_5, M_1 and M_3; stem of Cu is bordered with brown on its distal half and there is a shadow in anal field under fCu; wing-tip is slightly yellowish.

Length of body, 3½ mm.; wing, 4 mm.

Type: Aniseed Valley, Nelson, 21st Mar., 1922, in Cawthron Inst. coll.

Paratypes: *idem*, 1st Dec., 1923; and Nelson, 16th July, 1923.

The colouration is rather variable, sometimes the body is completely black and the antennae, palpi, and coxae also brownish-black.

2. **Mycetophila sylvatica** Marsh. (Fig. 106.)

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 301.

This species is easily distinguishable by its peculiar wing-marking as shown in fig. 106. The middle tibiae have sometimes four, sometimes only three external bristles. The black markings under hind femora are not always in shape of a stripe, but may assume the aspect of more or less roundish spots. The dorsal brownish spots on the posterior tibiae are sometimes almost absent.

Although not common this species is rather widely spread; it has been collected in: Waiho, 21st Jan., 1922; Otira, 9th Feb., 1922; Wellington, 9th Mar., 1923 (Tonn.); Ohakune (Harris); Queenstown (Curtis).

3. **Mycetophila curtisi** n. sp. Edw. (Figs. 105, 280.)

♂ *Head* ochreous, with black bristles. Antennae with first four segments brownish-ochreous, the rest blackish; flagellar segments about twice as long as broad. Palpi brownish-ochreous, rather long and slender. *Thorax* brownish-ochreous, prothorax and lower part of sternopleura lighter; a small darker area in front of scutellum; scutellum ochreous in middle, blackish towards sides and round posterior margin; hypopleurites mainly ochreous. Mesonotum considerably shining. All thoracic bristles black; four strong propleural;

about 12-15 very short pteropleural. *Abdomen* dark brown, segments margined posteriorly with light ochreous; tergites 2 and 3 also with a light ochreous sublateral stripe which does not quite reach base. *Hypopygium of the usual type; the claspers rather broad, small* lower division with one rather stout pointed spine. *Legs* ochreous; posterior coxae with narrow dark lines posteriorly, hind coxae also with another larger brown patch; hind femora broadly blackish at tip, four posterior femora each with a dark brown spot beneath near base. Bristles black; front coxal bristles not very strong and not extending to base. Middle tibiae with six dorsal, three external, three ventral and six internal bristles. *Wings* yellowish tinged; a large dark spot in middle, and a broad but irregular and ill-defined band at two-thirds, connected with a dark cloud between M_3 an Cu_1 wing-tip almost clear, except at tips of veins. Cubital fork rather wide, its base nearly level with fM. Halteres pale ochreous.

Length of body, about 5 mm.; wing, 5½ mm.

Type: Queenstown Water Works (L. Curtis), 8th Dec., 1922; in Brit Mus. coll.

Paratype: Raetihi Hill, 3000 ft. (T. R. Harris); 1 ♂, Nov., 1923.

4. **Mycetophila similis** n. sp. Tonn. (Figs. 104, 287.)

♂ *Head* dark orange with a dark thin streak on vertex; antennae brown with scape and base of third joint orange; palpi orange, darker towards extremity. *Thorax* mostly dark; mesonotum rather shining, brown on the disc, shoulders, sides and space in front of scutellum orange; a spot above each wing-base, a transverse streak in front of scutellum and scutellum blackish. Pleurae mostly brown with exception of propleurae. *Abdomen* brown with hind border of all segments and lateral margin of middle ones yellow. *Legs* yellow with blackish markings: posterior coxae dark on middle, the hind one much more extensively; middle femora with a dark spot below just before the middle and with another further, near tip; hind femora with a broad black apex and a black spot below before middle; tip of posterior tibiae black. Middle tibiae with six dorsal, three external, three ventral and six to seven internal bristles. *Wings* with yellowish-grey tinge, more yellowish anteriorly and with dark markings as follow: a dark spot on *r-m* and fM, a zig-zag transverse band at apical third, between these two a distinct shadow from M_3 towards fCu; tip of wing completely darkish; fCu just under the origin of *r-m*. Halteres yellowish.

♀ Similar to male the anal lamellae orange.

Length of body, 5 mm.; wing, 5½ mm.

Type: Hilltop, Banks Peninsula (Tonn.), 15th Jan., 1925, in Canterbury Museum coll.

Allotype: Mt. Arthur, 22nd Dec., 1921.

Specimens in Brit. Mus.: Stewart Is. (Curtiss), 14th Mar., 1923.

5. **Mycetophila elegans** n. sp. Tonn. (Fig. 108.)

♀ *Head* orange; antennae yellowish-orange gradually darker towards tip; palpi somewhat darker orange. *Thorax* orange with a dark spot just above wing-base and one in front of scutellum which is mostly dark; middle of postnotum dark; pteropleurae with numer-

ous hairs. *Abdomen* brownish-ochreous, the pale markings not definite; base of second segment and hind-margin of most of the others with exception of first yellow; lamellae orange. *Legs* as in *M. similis* but all dark markings much fainter and less extensive. Middle tibiae with five dorsal, three external, three ventral and six to seven internal bristles. *Wings* yellowish with dark markings as follow: a small spot on *r-m* and fM and an oblique zig-zag spot at apical fourth, also a small darkish spot near fCu. Halteres yellow.

Length of body, 4 mm.; wing, 4½ mm.

Type: Waiho (Tonn.), 30th Jan., 1922, in Cawthron Inst. coll.

Paratype: Lake Brunner, 6th Feb., 1922.

Specimens in Brit Mus.: Ohakune (Harris); Queenstown (Curtis); Mt. Grey (Campbell).

6. **Mycetophila latifascia** n. sp. Edw. (Fig. 97.)

♂ *Head* rather dark brown, face lighter. Antennae brownish-ochreous at base, darker apically, flagellar segments about twice as long as broad. Palpi rather light brown, long and slender. *Thorax* dull pale yellowish, bristles black, pubescence pale. Pronotum with a dark spot; mesonotum with three distinct blackish stripes, the middle one reaching front margin and indistinctly divided in front by a pale line; scutellum and postnotum black except at sides; pleurotergites and lower part of sternopleurite black; anepisternites with upper and anterior margins black; hypopleurite with a small dark spot. Five propleural bristles; about 10 short pteropleural hairs. *Abdomen* dark brown; hind margins of tergites pale ochreous; irregular ochreous markings also at bases and sides of tergites, more extensive in the ♀ than in the ♂. Anal lamellae of ♀ orange, the genital parts dark brown. *Legs* ochreous; posterior coxae with small dark marks in middle; hind femora rather broadly blackish at tip; the four posterior femora each with a dark brown spot beneath near base. Bristles black; middle tibiae with four to five dorsal, three external, two to three ventral and six to eight internal bristles. *Wings* yellow; a small dark brown spot in middle, and another in base of cell Cu_1; a broad dark brown band a little before tip running almost straight from costa to hind margin. Halteres whitish.

Length of body, 4½-5 mm.; wing, 4-5½ mm.

Type: Ohakune (T. R. Harris), Sept., 1922, in Brit. Mus. coll.

Allotype: Mt. Ruapehu, 4,500 ft. (T. R. Harris), Nov., 1924; Cass, 28th Nov.. 1924; Goose Bay, Kaikoura, 4th Feb., 1925 (Tonn.).

7. **Mycetophila howletti** Marsh. (Fig. 110.)

Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 302.

Easily recognizable on account of the extensive wing-markings as shown in fig. 110.

Besides the type's locality this species is known from: Queenstown (Curtis), and Raetihi (Harris).

8. **Mycetophila virgata** n. sp. Tonn. (Fig. 107.)

♂ *Head* dark orange; antennae brown with exception of scape which is orange as well as palpi. Mesonotum dark orange, darker posteriorly and with a yellowish streak in front of scutellum, this

streak extending on disc of scutellum itself; postnotum and pleurae mostly brownish-orange; pteropleurites with three to four long bristles and a few smaller ones. *Abdomen* brown with middle of base of segments 1-3 yellow and a narrow hind border on segments 2-6 yellow. Hypopygium orange. *Legs* yellowish-orange, posterior coxae brown on middle, femora more or less dark chiefly underneath. Middle tibiae with five dorsal, three external, one ventral, and five to six internal bristles. *Wings* somewhat greyish, slightly yellowish anteriorly with dark markings as follow: a moderately large spot on *r-m* and fM and a transverse curved rather narrow and faint band which does not reach costa nor hind-border of wing. fCu under base of *r-m*. Halteres yellow.

♀ Similar to male; anal lamellae dark orange.

Length of body, 4 mm.; wing 4½ mm.

Type: Mt. Arthur, 26th Dec., 1921 (Tonn.), in Cawthron Inst. coll.

Allotype: *idem,* 21st Dec.

Paratypes: *idem* and Otira, 9th and 10th Feb., 1922.

Sometimes the distal band on the wing is very faint, scarcely distinct.

Specimens in Brit. Mus.: Queenstown (Curtis); Governors Bay (Tapley); Ohakune (Harris); Mt. Grey (Campbell).

9. **Mycetophila vulgaris** n. sp. Tonn. (Fig. 111.)

♂ *Head* brown; antennae ochreous at base and gradually darker towards extremity; palpi dark. *Thorax* dull brown; mesonotum with a small yellowish area above wing-base; pteropleurites with three large bristles. *Abdomen* brown, hind margin of segments somewhat lighter. Hypopygium with claspers as in fig. 111. *Legs* yellow; middle tibiae with four dorsal (sometimes five), three external, one ventral, and three to five internal bristles. *Wings* subhyaline with dark markings as follow: a dark spot on *r-m* and fM and a transverse band from tip of R_1 growing fainter towards posterior border that it does not reach, tip of wing clear; fCu under *r-m*. Halteres yellow.

♀ Similar to male; anal lamellae dark orange.

Length of body, 3 mm.; wing, 3½ mm.

Type: 27th June, 1922 (Tonn.), in Cawthron Inst. coll.

Allotype: Nelson, 9th Oct., 1923 (Tonn.).

Paratypes: numerous from a great number of localities.

This common species is found on the wing nearly all the year round in both Islands and also in Stewart Island.

The thorax is sometimes more or less ochreous chiefly on the shoulders and the colour of the palpi is variable. The size varies also a great deal, the wings of the largest specimens being 4½ and of the smallest 2½ mm.

10. **Mycetophila trispinosa** n. sp. Tonn. (Fig. 288.)

♂ Very similar to *M. vulgaris* from which it is distinguished with certainty only by the structure of the hypopygium, the claspers of which being provided with two strong blackish truncated spines. The antennae palpi and thorax are dark as in the small specimens of *vulgaris.*

♀ with dark orange anal lamellae.

Length of body and wing, 2½ mm.

Type: Mt. Arthur, 22nd Dec., 1921 (Tonn.), in Cawthron Inst. coll.

Allotype: *idem,* 20th Dec.

11. **Mycetophila elongata** n. sp. Tonn. (Fig. 112.)

♂ *Head* brown antennae with base somewhat lighter; palpi dark. *Thorax* dull brown with some ochreous small areas below shoulder and around wing-base. *Abdomen* brown with somewhat indistinct paler hind border to middle segments. *Legs* yellow, last half of posterior coxae black also a dark spot below base of posterior femora, tip of hind femora black. Middle tibiae with four dorsal, two external, one ventral, and four internal bristles. *Wings* subhyaline with dark markings as follow: a transverse zig-zag band starting at costa and passing over *r-m,* fM and fCu and growing fainter towards posterior border; another transverse broader and straighter band at last third of wing; from that band the distal part of wing is distinctly darker than basal part, the centre of this area being, however, a little clearer; fCu under *r-m.* Halteres yellow.

♀ Similar to male; anal lamellae orange.

Length of body, 3 mm.; wing, 3½ mm.

Type: Mt. Arthur, 24th Dec., 1921 (Tonn.), in Cawthron Inst. coll.

Allotype: *idem,* 22nd Dec.

Paratype: Hilltop, Banks Peninsula, 16th Jan., 1925; Nelson, 23rd May, 1922, 16th June, 1923; Cass, 18th Feb., 1925; Kaitouna, 16th Feb., 1922 (Tonn.).

Specimens in Brit. Mus.: Queenstown; Governors Bay; Ohakune; Raetihi hill; Mt. Grey.

12. **Mycetophila consobrina** n. sp. Tonn. (Fig. 101.)

♀ *Head* brownish; antennae brown with exception of scape and base of third joint orange; palpi darkish. *Thorax*: mesonotum orange with two darkish areas in front and extending on scutellum; postnotum nearly entirely dark; pleurae mostly brown; pteropleurites with three long bristles and a few smaller ones. *Abdomen* brown with a contrasted yellow lateral and hind-margin to all segments; anal lamellae orange. *Legs* mostly yellow, tip of posterior coxae dark, a small brown spot below base of posterior femora, tip of posterior femora and tibiae black. Middle tibiae with four dorsal, three external, two ventral, and four to five internal bristles. *Wings* somewhat yellowish on anterior margin and with dark markings as follow: a rather extensive brown spot on *r-m* and fM prolonged posteriorly by a shadow going over M_3 and fCu; a transverse zig-zag band placed on the distal third of wing, this wing being rather broad and dark but growing gradually fainter towards posterior border; the whole apex dark but much fainter than the other dark markings. Halteres yellowish.

Size of body and wing, 3½ mm.

Type: Otira (Tonn.), 7th Feb., 1925, in Cawthron Inst. coll.

Paratype: Waiho, 21st Jan., 1922; Kaitouna, 11th Sept., 1921 (Campbell).

13. **Mycetophila marshalli** End. (Fig. 99.)

Marshall, *Trans N.Z. Inst.*, 28, 1896, p. 306, pl. 12, fig. 2 (*M. maculata*).

Enderlein, *Stett. Ent. Zeit*, vol. 72, 1910, p. 174.

This species is characterized by the large central spot which reaches the costa and by the wing-tip very distinctly darkened; there is besides only one ventral bristle on the middle tibiae.

Nelson (Tonn.), 5th Dec., 1923; Dunedin (Howes), 1st Aug., 1922; Queenstown (Curtis); Governors Bay (Tapley); Mt. Albert (Brookes).

14. **Mycetophila pseudomarshalli** n. sp. Tonn.

Very similar to the preceding species; the chaetotaxy of the middle tibiae is the same but the wing-tip is quite clear and the transverse subapical dark band is narrower and fainter posteriorly. In the female the hind yellow border is more conspicuous and present on all the abdominal segments.

Type: Nelson (Tonn.), 14th Sept., 1923, in Cawthron Inst. coll.

Allotype: Khandallah (Tonn.), 30th Nov., 1921.

Paratypes: Cass, 20th Feb., 1925; Nelson, 28th Sept., 1923; Hilltop, 14th Jan., 1925; Lake Brunner, 2nd Feb., 1922 (Tonn.).

15. **Mycetophila minima** n. sp. Edw.

♀ *Head* dark brown, with black bristles. Antennae short, flagellar segments not longer than broad; first three segments brownish-ochreous, the rest black. Palpi ochreous. *Thorax* uniformly reddish-brown; bristles black; pubescence light. Three pteropleural bristles. *Abdomen* dark brown, rather shining; posterior margins of segments ochreous; anal and genital parts orange. *Legs* ochreous; hind femora and tibiae black at tips; hind coxae with a small dark mark at tip behind. Middle tibiae with four dorsal, two external, one ventral, and two internal bristles; hind tibiae with four dorsal and five external bristles. *Wings* slightly yellowish; a small dark spot over *r-m*, just extending into base of cell M_1, a large dark spot filling the end of costal cell and the middle of cells R_1 and R_5, stopping short at M_1; fCu below or just before fM. Halteres ochreous.

Length of body or wing, 2·3 mm.

Type: Queenstown Water Works (L. Curtis), 8th Dec., 1922, in Brit. Mus. coll.

Paratype, *idem.* 3rd Nov., 1924.

16. **Mycetophila submarshalli** n. sp. Tonn.

Very similar to *M. marshalli,* wing-markings being practically the same. The mesonotum is, however, somewhat lighter as a rule and middle tibiae are provided with two ventral bristles. In female the preapical transverse band is particularly wide and comes nearly into contact with the central spot. Same size.

Type: Nelson (Tonn.), 6th Nov., 1923, in Cawthron Inst. coll.

Allotype: *idem.*

Paratypes: *idem* and 20th Sept., 1923; Kaikoura, 23rd Feb., 1922.

Specimens in Brit. Mus.: Queenstown (Curtis).

17. **Mycetophila marginepunctata** n. sp. Tonn. (Fig. 114.)

♂ *Head* with appendages orange; antennae gradually darker towards extremity. *Thorax* orange; mesonotum rather shining and with a small dark spot above wing-base and another in front of scutellum which is brown except on sides; middle of postnotum brown; lower part of hypotergites and sternopleurites brownish; numerous hairs on pteropleurites. *Abdomen* mostly orange: first segment nearly completely dark, the following ones with a dark dorsal rather narrow marking; sides of segments 4-6 also dark. *Legs* yellow, posterior coxae with a few rather faint markings, chiefly about middle, a roundish brown spot below base of posterior femora, tip of hind-femora and of posterior tibiae dark. Middle tibiae with five dorsal, four external, two ventral, and six to seven internal bristles, two only of these last being large. *Wing* with a yellowish tinge and markings as follow: a small black central spot on *r-m* and fM, also a rather faint shadow at tip of all veins; fCu below *r-m*. Halteres yellow.

♀ Similar to male; *abdomen* lighter on the sides.

Length of body and wing, 4 mm.

Type: Khandallah, 30th Nov., 1921 (Tonn.), in Cawthron Inst. coll.

Allotype: *idem*.

Paratype: Mt. Arthur, 25th to 27th Dec., 1921; Dun Mt., 5th Jan., 1922; Kaikoura, 22nd Feb., 1922; Lake Brunner, 3rd Feb., 1922; Nelson, 20th Sept., 1923; Cass, 20th Feb., 1925 (Tonn.).

Specimens in Brit. Mus.: Stewart Is. (Curtis); Queenstown; Governors Bay (Tapley); Ohakune (Harris); Raetihi (Harris); Mt. Grey (Campbell).

The size is rather variable, the wing length varying from 3½ to 5½ mm.

18. **Mycetophila marginepunctata** var. **ruapehuensis** nov. (Fig. 113.)

Differs from the typical form as follows:—

Size rather larger. Spots at tips of veins larger and rather sharply defined. Distinct brown clouds in the middle of cells R_1 R_5, M_1, and M_3, forming a rather faint and interrupted band.

Length of body, 5½ mm.; wing about 6 mm.

Type: Mt. Ruapehu, 4,000-5,000 ft. (T. R. Harris), in Brit. Mus. coll; several specimens, Nov., 1922 and Nov., 1924. Clifton (T. R. Harris); one specimen, 20th Nov., 1919; Mt. Arthur, 21st Dec., 1921; Kaitouna, 19th Nov., 1922; Cass, 1st Dec., 1924 (Tonn.).

19. **Mycetophila marinepunctata** var. **rotundipennis** nov. (Fig. 114.)

Differs from the type form in shape of wings, which are barely twice as long as broad: length 4·7 mm.; breadth 2·4 mm.; in connection with this alteration in shape, cubital fork much more widely open than usual. Hypopygium and chaetotaxy as in the type.

Type ♂: Ohakune (T. R. Harris); July-Aug., 1922, in Brit. Mus. coll.

20. **Mycetophila nitens** n. sp. Tonn. (Figs. 98, 268, 269.)

♂ *Head* and body shining black with dark pubescence and bristles; palpi yellowish; antennae brown with base scarcely lighter if at all;

Pteropleurae with a few bristles (two to three); Hypopygium as in figs. 268, 269, upper pair of claspers with a long point which carries two bristles at end. *Legs* yellow: tip and base of hind-coxae very slightly dark; tip of posterior femora dark, that of the hind ones much more extensively; tip of posterior tibiae also brown. Middle tibiae with five dorsal, three external, two very long ventral and no internal bristles. *Wings* subhyaline with a dark central spot on *r-m* and fM and apical two-fifths of membrane dark the anterior part of that fascia down to M being much darker than the rest. Halteres whitish.

♀ Similar to male, anal lamellae dark.

Length of body 2¼ mm., wing 2½ mm.

Type: Aniseed Valley, Nelson (Tonn.), 22nd Mar., 1922, in Cawthron Inst. coll.

Allotype: Ohakune (Tonn.), 8th Mar., 1923.

Paratypes: Nelson, 8th Apl., 1922; Mt. Arthur, 26th Dec., 1921; Waiho, 20th Jan., 1922; Otira, 10th Feb., 1922; Hilltop, 15th Jan., 1925; Cass, 20th Feb., 1925.

21. **Mycetophila subnitens** n. sp. Edw. (Fig. 272.)

♂ Resemble *M. nitens* in all respects except in structure of hypopygium the claspers of which are differently shaped: the upper pair is blunter and carries only one longish bristle instead of two, the lower pair is rather smaller with the bristles shorter and stouter.

Type: ♂ Queenstown (Curtis), 14th Sept., 1923.

Paratypes: Leith Valley (Howes)*; Otira (Tonn.); Ben Lomond (Curtis); Ohakune and Mt. Ruapehu (Harris).

22. **Mycetophila nitidula** n. sp. Edw. (Figs. 270, 271.)

Differs from *M. nitens* as follows:—

Scape of antennae often brownish-ochreous. Costa produced slightly beyond end of R_5. The lower part of wing-tip quite clear, or at most darkened only along margin, though a large dark brown mark fills outer two-thirds of cell R_1 and middle third of cell R_5; no trace of darkening round fCu, such as is usually though not invariably present in *M. nitens*. Anal lamellae of female clear orange; those of male longer and more pointed. Male claspers differently shaped, the lower pair with two or three strong bent bristles.

Type ♂: Mt. Ruapehu, 4,000 ft. (T. R. Harris), in Brit. Mus. call., 28th Nov., 1922; Ohakune (T. R. Harris); 1 ♂ 4 ♀, Sept., 1922, May-July, 1923 and Jan., 1924; Queenstown (L. Curtis), 1 ♂, 25th Mar., 1923.

23. **Mycetophila nigripalpis** n. sp. Edw.

♀ Differs from *M. nitens* as follows:—

Palpi black. Anal lamellae much narrower. *Wing*-markings very faint, especially the small central spot; lower part of wing-tip from M_1 to hind-margin is quite clear. R_5 meeting costa at a rather less acute angle, the costa therefore appearing to end more abruptly at tip of R_5.

Type: Ohakune (T. R. Harris), Nov., 1922, in Brit. Mus. coll.

Ben Lomond, 2,500 ft. (L. Curtis) also has black palpi, but has the wings as strongly marked as in *M. nitens*.

24. **Mycetophila phyllura** n. sp. Edw. (Figs. 109, 273.)

Head dark brown; bristles black; pubescence dark. Antennae with scape ochreous, flagellum blackish, segments about half as long as broad. Palpi blackish. *Thorax* dull reddish-brown, more ochreous-brown in the female; scutellum, postnotum and pleurae darker; bristles black. Three propleural bristles, not very strong. Pteropleurites with about ten bristly hairs, two or three of which are a little longer than the others. *Abdomen* dark brown, with narrow yellow bands which occupy both anterior and posterior margins of segments. Genitalia ochreous in both sexes; male claspers large, flattened, of very simple structure and directed backwards. *Legs* ochreous, bristles black; apical half of the four posterior coxae, a mark underneath the four posterior femora at base, broad tips to hind femora and tips of the tibiae dark brown. Middle tibiae with four to five dorsal, two external, two or three short ventral, and four internal bristles. *Wings* with a slight yellowish tinge; a dark brown spot over *r-m* and base of Rs, extending into base of cell M_1; apical two-fifths of wing brownish, darker anteriorly towards costa; fCu a little beyond fM. Halteres ochreous.

Length of body, 3-4 mm.; wing, 3-4 mm.

Type ♂: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratype 3 ♂ 3 ♀, July-Sept., 1922, and May-July, 1923; Governors Bay (J. F. Tapley); 2 ♂ Sept., 1922; Queenstown Water Works (L. Curtis); 1 ♂ 1 ♀, 8th Dec., 1922.

25. **Mycetophila subtilis** n. sp. Tonn.

♀ *Head* brown; appendages also dark, base of antennae somewhat lighter. *Thorax* and *abdomen* brown, sides of scutellum ochreous; anal lamellae orange. Pteropleurites with numerous hairs only, no bristles. *Legs* yellowish; posterior coxae somewhat darkened, posterior femora brownish at base below. Middle tibiae with four dorsal, two external, no ventral and three to four (equally small) bristles. *Wings* with a central dark spot on *r-m* and f-M and a brownish faint suffusion on anterior border at apical third of wing. fCu below fM. Halteres yellow.

Length of body, 3½ mm., wing, 4 mm.

Type: Mt. Arthur, 26th Dec., 1921 (Tonn.), in Cawthron Inst. coll.

26. **Mycetophila diffusa** n. sp. Tonn. (Fig. 103.)

♂ *Head* brown; palpi and scape yellowish, flagellum brown. *Thorax* dull ochreous-brown. Pteropleurites with four bristles. *Abdomen* brown with a yellowish triangle on sides of middle segments. *Legs* completely yellow. Middle tibiae with five dorsal, three external, two ventral and three internal (one long) bristles. *Wings* with rather faint markings: a central spot on *r-m* and fM fused with the dark shadow extending in distal half of costal cell; wing-tip completely greyish-brown but more intensely on the front border. Halteres yellow, base of knob dark.

♀ Similar to male, *abdomen* nearly completely black, lamellae dark orange.

Length of body and wing 2½ mm.

Type: Maitai Valley, Nelson (Tonn.), 17th Mar., 1922, in Cawthron Inst. coll.

Allotype: Mt. Arthur (Tonn.), 22nd Dec., 1922.

Paratypes: Cass (Tonn.), 21st Feb., 1925.

Specimens in Brit. Mus.: Queenstown (Curtis); Ohakune (Harris); Mt. Torlesse (Marshall); Mt. Grey (Campbell.)

27. **Mycetophila grisescens** n. sp. Edw. (Figs. 102, 267.)

Head blackish, with black bristles and light pubescence. Antennae with first two and base of third segments brownish-ochreous, the rest black; flagellar segments about twice as long as broad. Palpi slender, black. *Thorax* almost completely dull blackish-grey, only pronotal lobes and hypopleurites lighter; bristles dark, pubescence light brown. Three propleural and three pteropleural bristles. *Abdomen* blackish, posterior lateral corners of tergites ochreous, hair dark. Genitalia of both sexes black; hypopygium small, somewhat resembling that of *M. diffusa*. *Legs* light ochreous with black bristles; coxae unmarked; posterior femora with a small dark mark at base beneath; hind femora narrowly dark at tip. Mid-tibial bristles five dorsal, two external, two ventral, two to three internal. *Wings* with ground-colour clear; a rather large but diffuse brownish spot in middle, not reaching costa; outer third of wing smoky, darker towards costa; fCu much beyond fM. Halteres light ochreous.

Length of body or wing 3 mm.

Type ♂: Ohakune (T. R. Harris), May-July, 1923; allotype ♀ Oct.-Nov., 1923; Mt. Grey (J. W. Campbell); 1 ♂, 23rd Feb., 1924.

28. **Mycetophila lomondensis** n. sp. Edw.

♂ *Head,* including antennae and palpi, *thorax* and *abdomen* uniformly blackish. Basal flagellar segments about twice as long as broad, the last few shorter; three distinct pteropleural bristles, besides a few hairs in posterior corner. Hypopygium constructed almost as in *M. intermedia* Edw., but the basal lobe of claspers larger. *Legs* brownish-ochreous; posterior coxae somewhat darkened; posterior femora with ill-defined dark brown patches at base beneath; hind-femora also dark beneath at tip; spurs and tarsi dark. Middle tibiae with four dorsal, two external, two very small ventral, and three small and one long internal bristles. Hind tibiae with five dorsal, four external and three small internal bristles. *Wings* brownish-tinged; a small but rather distinct black central spot; traces of a darker shade on outer third of wing towards costa; fCu a little beyond fM. Halteres ochreous, base of knob a little dark.

Length of body and wing 3.2 mm.

Type: Ben Lomond, 5,000 ft., 3rd Dec., 1922 (L. Curtis) in Brit. Mus. coll.

29. **Mycetophila nigricans** n. sp. Tonn.

♀ Body completely brown, *thorax* somewhat lighter than *abdomen*; anal lamellae dark. Antennae palpi and *legs* dark, front pair of legs and all tibiae a little lighter. Pteropleurae with three long bristles and a few hairs. Chaetotaxy of middle tibiae quite peculiar

owing to the presence of four very small ventro-internal bristles, besides the four dorsal, two external and two internal (one long).

Wing-markings rather similar to *M. diffusa,* costal cell being also obscured, this shadow extends, however, here into cell R; distal part of wing extensively darkened but not strongly. Halteres yellow with base of knob blackish.

Length of body and wing 3½ mm.

Type: Mt. Arthur, 26th Dec., 1921 (Tonn.), in Cawthron Inst. coll.

Specimen in Brit. Mus.: Ohakune (Harris).

30. **Mycetophila grandis** n. sp. Tonn.

♂ *Head* dark orange; palpi long, orange; antennae orange at base and gradually darker towards extremity. *Thorax*: mesonotum obscure orange with brown narrow median line posteriorly which extends over whole disc of scutellum and middle of pronotum; a small blackish spot above wing-base. Pleurae orange with upper part of anepisternum and propleurae brownish. Pteropleurites with numerous short hairs. *Abdomen* brown with base of segments extensively orange. *Legs* rather elongate, yellowish; tip of hind-tibiae black; mid-tibiae with five dorsal, three external, two ventral and eight to nine (two long) internal bristles. *Wings* yellowish without distinct central spot. fCu below fM. Halteres yellowish.

♀ Similar to male, *abdomen* more extensively pale.

Length of body and wing, 6 mm.

Type: Waiho (Tonn.), 20th Jan., 1922, in Cawthron Inst. coll.

Allotype: Maitai Valley (Tonn.), 17th Mar., 1922.

Paratype: *idem.*

Specimens in Brit. Mus.: Wiltons Bush (Hudson); Wainuiomata (Hudson); Ohakune and Raetihi (Harris); Queenstown (Curtis); Greymouth (Osten-Sacken coll.).

31. **Mycetophila subspinigera** n. sp. Tonn. (Figs. 282, 283.)

♂ *Head* orange; antennae and palpi gradually darker towards extremity, base being orange. *Thorax* completely orange. The pteropleurae with hairs, only a few being longer than the others, and being sometimes long and strong as true bristles. *Abdomen* brown: first segment and lateral and posterior margin of the others yellowish. Hypopygium orange; claspers as in figs. 282, 283. *Legs* completely yellow. Middle tibiae with four dorsal, three external, one ventral, and three (one large) internal bristles. *Wing* subhyaline, unmarked; fCu a little over fM. Halteres yellow, base of knob rather extensively dark.

♀ Similar to male; *abdomen* more yellowish chiefly on the second segment.

Length of body and wing, 3 mm.

Type: Waiho (Tonn.) 23rd Jan., 1923, in Cawthron Inst. coll.

Allotype: Kaikoura, 24th Feb., 1923.

Paratypes: Purau Creek, 20th Feb., 1922; Christchurch, 18th Feb., 1922; Kaitouna, 19th Feb., 1922; Nelson, 15th Dec., 1922; Lake Brunner, 3rd Feb., 1922; Ohakune, 8th Mar., 1923; Hilltop, 15th Jan., 1925.

Specimens in Brit. Mus.: Mt. Albert (Brookes); Auckland (O-S); Governors Bay (Tapley); Queenstown (Curtis); Ohakune (Harris).

Exceptionally there may be three dorsal bristles or an additional external bristle on the middle tibiae.

This species is one of the most abundant.

32. **Mycetophila fumosa** n. sp. Tonn. (Fig. 118.)

♂ *Head* brown; palpi and base of antennae up to fourth segment orange, the rest gradually darker. *Thorax* completely brown but for a very small space on both sides of scutellum. *Abdomen* completely brown. *Legs* yellow, posterior coxae with some slight brown markings near the tip; base of posterior femora below with a brown spot; tip of hind-femora brown. Middle tibiae with five to six dorsal, three external, two ventral (sometimes an additional small one), and five (one large) internal bristles. *Wings* with a slight brownish yellow tinge, without markings; fCu below fM. Halteres yellow.

♀ Similar to male; posterior border of the middle abdominal segments orange on the sides; anal lamellae orange.

Length of body and wing, 4 mm.

Type: Nelson, 15th Dec., 1921, in Cawthron Inst. coll.

Allotype: Otira, 9th Feb., 1922.

Paratypes: *idem.*

33. **Mycetophila griseofusca** n. sp. Tonn.

♂ *Head* and body entirely blackish-brown; palpi black; antennae brown somewhat lighter at base, *legs* yellowish-orange; posterior coxae blackish at base; posterior femora marked with brown at base below. Middle tibiae with three dorsal, two external, no ventral, and three (all small) bristles. *Wing* with yellowish-grey tinge, unmarked. fCu below fM. Halteres yellow.

Length of body and wing, 3½ mm.

Type: Mt. Arthur (Tonn.), 20th Dec., 1921, in Cawthron Inst. coll.

34. **Mycetophila griseofusca** var **nigriclava** nov. Edw.

♂ Differs from the typical form of the species as follows:—

Femora scarcely darkened beneath. Hind-tibiae with four bristles in the outer row instead of only three. Knob of halteres all black. Upper claspers rather narrower; lower claspers with only four instead of seven to eight blunt slightly flattened spines; aedoeagus also of a slightly different shape.

Type: Governors Bay (J. F. Tapley), 30th Nov., 1922, in Brit. Mus. coll.

35. **Mycetophila viridis** n. sp. Edw.

♂ *Head* light ochreous; bristles black, pubescence yellowish. Antennae with scape pale ochreous; flagellum blackish, segments long and slender, over three times as long as broad. Palpi slender, brownish. *Thorax* light green, the mesonotum with an ochreous tint, bristles all black, also the mesonotal pubescence. A small dark spot in front of scutellum, on to which it extends in middle; another dark spot at base of the postnotum, in some specimens forming a median line. Four propleural bristles; pteropleurites with three short brist-

les and about six smaller hairs. *Abdomen* brownish; posterior and lateral margins of segments ochreous. Hypopygium small, claspers of the *fungorum* type, but rather short, lower division with four short spines. *Legs* slender, coxae and femora light green; tibiae and tarsi pale ochreous; bristles black. Middle tibiae with five dorsal, three external, one long ventral and five to six internal bristles. *Wings* with a slight brown tinge; veins light brown; no trace of markings; fCu well beyond fM. Halteres with greenish stem and dark knob.

Length of body and wing, 3½ mm.

Type: Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes 5 ♂, Sept., 1922.

36. **Mycetophila pollicata** n. sp. Edw. (Fig. 276.)

Head dark brown, including antennae and palpi; base of antennae lighter. Flagellar segments about twice as long as broad. *Thorax* ochreous, bristles black; pleurae slightly darker; hypopleurites bright ochreous, with a dark spot at the hairy posterior corner. Four propleural bristles; pteropleurites with about six short hairs, no distinct bristles. *Abdomen* dark brown, posterior margins of segments indistinctly ochreous in male, more conspicuously so in female, especially on segments 5 and 6, which are sometimes nearly all ochreous at sides. Anal lamellae of female orange, genital parts black. Hypopygium of ♂ of the *fungorum* type; upper claspers with a rather long thumb-like projection on inner side at base; lower claspers on inner side with only three short bristly spines. *Legs* orange; tarsi darkened; bristles black. Mid-tibiae with four dorsal, two external, one rather long ventral, and two to three internal bristles. *Wings* almost clear; veins brownish, no trace of darkening on *r-m;* fCu a little beyond fM. Halteres with brown knob.

Length of body or wing, 3-4 mm.

Type ♂: Ohakune (T. R. Harris); paratypes 1 ♂ 5 ♀, Sept., 1922 and May-July, 1923.

37. **Mycetophila luteolateralis** n. sp. Edw.

Resembles *M. pollicata* in most respects, and possibly only a variety of it, but differs in the colour of abdomen, which is completely orange at sides, each segment with a dark brown mark in mid-dorsal line which does not quite reach posterior margin.

Type ♀: Governors Bay (J. F. Tapley), Aug., 1922; Ohakune (T. R. Harris); 1 ♀, Aug., 1922.

38. **Mycetophila crassitarsis** n. sp. Edw. (Fig. 281.)

♂ *Head* brownish, face darker. Antennae slender, with first three or four segments ochreous, the rest blackish; flagellar segments nearly twice as long as broad. Palpi dark brown. *Thorax* uniformly reddish-brown, bristles black. Three propleural bristles; pteropleurites with six to eight short hairs, no well-marked bristles. *Abdomen* dark brown, lighter towards base. Hypopygium of the *fungorum* type; upper clasper with thumb-like process at base; lower claspers with about four blunt spines; the whole structure very much like that of *M. pollicata*. *Legs* ochreous; tarsi darkened; bristles black. Middle tibiae with four dorsal, two external, one fairly long ventral,

and three internal bristles. Segments 2-4 of front tarsi much thickened beneath, segments 3 and 4 subequal in length. *Wings* unmarked, veins rather dark brown; fCu a little beyond fM. Knob of halteres dark brown.

Length of body or wing, about 3 mm.

Type: Ohakune (T. R. Harris), July, 1922, in Brit. Mus. coll.; paratypes 3 ♂, May-July, 1923. Governors Bay (J. F. Tapley); 1 ♂ Sept., 1922.

39. **Mycetophila tapleyi** n. sp. Edw. (Fig. 286.)

♂ Differs from *M. crassitarsis* as follows:

Front tarsi less swollen beneath, though very distinctly thickened; third segment distinctly longer than fourth. Mid-tibiae without a ventral bristle. Claspers differently shaped, the upper pair shorter, the middle division relatively longer and with spiny bristles round margins, fig. 286.

The female, if correctly associated, differs in having the front tarsi quite slender.

Type: Governors Bay (J. F. Tapley), in Brit. Mus. coll., 8th-9th Sept., 1922; 1 ♀, 21st-27th Aug., 1922; Ohakune (T. R. Harris); 1 ♀, May-July, 1923.

40. **Mycetophila dilatata** n. sp. Tonn. (Fig. 119.)

♂ *Head* and appendages orange, last half of antennae gradually daker, segments of flagellum not much longer than broad. *Thorax* orange, a small darkish area in front of and on disc of scutellum. Pteropleurites with four long bristles. *Abdomen* with first and second segments mostly yellow, the following ones brown with hind-margin and sides yellow. *Legs* yellow, tip of hind-femora and tibiae brown. *Wings* yellowish unmarked with a very much dilated anal field; fCu a little after fM. Halteres yellow.

♀ Similar to male, *abdomen* nearly entirely yellow.

Length of body, $2\frac{1}{2}$ mm., wing $2\frac{3}{4}$ mm.

Type: Mt. Arthur (Tonn.), 22nd Dec., 1921, in Cawthron Inst. coll.

Allotype: *idem*, 24th Dec.

Paratypes: Dun Mt., 5th Jan., 1922; Nelson, 14th Nov., 1923; Cass, 20th Feb., 1925; Okarahia, 5th Feb., 1925 (Tonn.).

Specimens in Brit. Mus.: Queenstown and Ben Lomond (Curtis); Mt. Grey (Campbell); Paradise (Fenwick); Ohakune (Harris).

Very variable in colour, especially of abdomen; some females are entirely orange.

41. **Mycetophila colorata** n. sp. Tonn. (Figs. 117, 279.)

♂ *Head* brownish; palpi orange; antennae with basal third orange the rest gradually darker. *Thorax* brownish, mesonotum somewhat lighter, sides anteriorly and a region above wing-base ochreous, also a lighter streak in front of scutellum which is prolonged on disc and tip of scutellum itself. Pteropleurites with about five long bristles. *Abdomen* brown, hind-margin of segments narrowly orange. Hypopygium orange. *Legs* yellow, tip of posterior tibiae black. Middle tibiae with four (sometimes five) dorsal, four external, two ventral

(sometimes one), and three to four (one large) internal bristles. *Wings* subhyaline, anterior border slightly yellowish, a dark well-marked central spot on *r-m* and fM; fCu below fM. Halteres yellow.

♀ Similar to male, antennae somewhat lighter; anal lamellae orange.

Length of body 3½ mm., wing 4 mm.

Type: Christchurch (Tonn.), 17th Feb., 1922, in Cawthron Inst. coll.

Allotype: *idem.*

Paratypes: Otira, 8th Feb., 1922; Nelson, 4th Mar., 1922; Wellington, 1st Dec., 1921; Mt. Arthur, 26th Dec., 1921; Wairakei, 6th Mar., 1923; Cass, 18th Feb., 1925; Goose Bay, 4th Feb., 1925; Nehotupu, 23rd Feb., 1923.

Specimens in Brit. Mus.: Queenstown; *Governors Bay*; *Ohakune*; Greymouth.

This is a rather variable species especially in the amount of yellow on abdomen.

42. **Mycetophila clara** n. sp. Tonn. (Fig. 278.)

♂ *Head* with appendages orange; antennae hardly darker towards extremity. *Thorax* orange; mesonotum with two darkish streaks behind which extend on scutellum; postnotum dark in middle. Pteropleurites with four to five long bristles. *Abdomen* orange sometimes a little darkened on middle of tergites. Hypopygium orange. *Legs* yellow, tip of hind-femora and tibiae narrowly black. Middle tibiae with four dorsal, four external, one ventral, and five to six (one long) internal bristles. *Wings* as in preceding species but fCu placed before *r-m*. Halteres yellow.

♀ Similar to male (the only female, the allotype, has two ventral bristles on the middle tibiae, but this may be an individual character).

Length of body, 3½ mm.; wing, 4 mm.

Type: Wellington, 1st Dec., 1921, in Cawthron Inst. coll.

Allotype: Goose Bay (Tonn.), 3rd Feb., 1925.

Paratypes: Ohakune, 8th Mar., 1923; Wairakei, 6th Mar., 1923; Nelson, 16th Mar., 1923 (Tonn.).

Specimens in Brit. Mus.: Ohakune (Harris).

43. **Mycetophila solitaria** n. sp. Tonn.

♂ *Head* brown; basal half of antennae dark orange, the rest gradually brown; palpi dark orange. Mesonotum rather shining, dark orange with three wide black stripes, the middle one cuneiform nearly fused with lateral ones behind; disc of scutellum black; postnotum broadly black in middle; pleurae mostly brown. *Abdomen* brown with hind-border of segments 2-6 yellowish. *Legs* yellow, posterior coxae with a slight dark shadow on middle. Hind femora broadly black at tip. Middle tibiae with four dorsal, three external, one ventral and four to five (one long) internal bristles. *Wings* yellowish-grey without markings; fCu below origin of *r-m*. Halteres yellow.

♀ Similar to male but a little lighter coloured; mesonotal dark bands not so wide, median one with a distinct yellowish line in middle anteriorly.

Length of body and wing, 3½ mm.

Type: Nelson (Tonn.), 16th Mar., 1923, in Cawthron Inst. coll.

Allotype: Nelson (Tonn.), 16th Mar., 1923.

Paratypes: Nelson, 20th Sept., 1923; Kaikoura, 23th Feb., 1922; Ohakune, 8th Mar., 1923.

Specimens in Brit. Mus.: Queenstown, Ben Lomond and Elgin Bay (Curtis); Governors Bay (Tapley); Ohakune (Harris); Greymouth (O-S coll.).

This species is rather variable in size, the wing-length of the largest specimens being 4 mm. and of the smallest 2½ mm.

44. **Mycetophila fagi** Marsh. (Fig. 284.)
Marshall, *Trans. N.Z. Inst.*, 28, 1896, p. 303.
— *M. variabilis* Marsh., *ibid.* p. 304.

This species is well characterized by the ringed antennae, the three spots on the mesonotum and the chaetotaxy of the middle tibiae as well as the completely yellow legs. The pteropleurites carry four long bristles.

It is the most common of the New Zealand *Mycetophila* and is found everywhere on the three Islands practically the whole year round. Some aberrant specimens may present only two external bristles on the middle tibiae.

45. **Mycetophila unispinosa** n. sp. Tonn.

♂ *Head* dark orange; antennae orange on basal third, then gradually darker; palpi orange, last segment darker. *Thorax* dark orange mesonotum dull. *Abdomen* brown with hind-margin of segments 2-6 yellow, hypopygium orange. *Legs* yellow posterior coxae slightly dark on their middle. Middle tibiae with four to five dorsal, three external, five ventral (one long with one small above and three small below), and six to eight internal (two long) bristles. *Wings* yellowish with a rather large but not strong spot on *r-m* and fM; fCu below *r-m*. Halteres yellow, base of knob somewhat darker.

♀ Similar to male, *abdomen* somewhat lighter.

Length of body, 4 mm.; wing, 4½ mm.

Type: Otira, 10th Feb., 1922, in Cawthron Inst. coll.

Allotype: Hilltop (Tonn.), 15 Feb., 1925.

Paratypes: Maitai Valley, Nelson, 17th Mar., 1922; Dun Mt., 5th Jan., 1922; Nehotupu, 5th Feb., 1923; Waiho, 28th Jan., 1922; Ohakune, 8th Mar., 1923; Goose Bay, 4th Feb., 1925 (Tonn.).

Specimens in Brit. Mus.: Queenstown (Curtis); White Rock (Campbell); Ohakune (Harris); Raetihi.

46. **Mycetophila impunctata** n. sp. Edw.

♀ *Head* ochreous above, face blackish. Antennae brownish-ochreous, the last six to eight segments blackish; first flagellar segments four to five times, the next five segments about three times as long as broad, remaining segments rather shorter. Palpi blackish. *Thorax* uniformly ochreous, bristles black; dorsocentral and acrostichal series more distinct than usual, and the middle pair of scutellar bristles rather wide apart. Four propleural bristles; pteropleura with three distinct bristles and a few short hairs. *Abdomen* ochreous, darker

dorsally except on the hind margins of the segments; segments 5-7 blackish beneath; genitalia ochreous. *Legs* ochreous; front coxae darkened outwardly; bristles black. Middle tibiae with three dorsal, three external, one ventral and two internal bristles. *Wings* slightly yellowish, anterior veins darkened, no markings; fCu beyond fM. Knob of halteres brownish.

Length of body or wing, 5 mm.

Type: Ben Lomond, 5,000 ft. (L. Curtis), in Brit Mus. coll. A damaged specimen, 3rd Dec., 1922, same locality.

This species seems quite distinct from others of this group by the presence of only three dorsal bristles on the middle tibiae. It is superficially extremely similar to the European *M. fungorum* Deg. (*punctata* Mg.)

47. **Mycetophila filicornis** n. sp. Tonn.

♂ *Head* brownish; basal third of antennae orange the rest gradually darker; palpi brown. *Thorax* brownish-orange; mesonotum with a black spot above wing-base and a dark marking in front of scutellum, this one dark except on sides; postnotum brown on middle, pteropleurites with three long bristles and a few smaller ones. *Abdomen* brown, hind-margin of segments indistinctly yellow; Hypopygium orange. *Legs* entirely yellow. Middle tibiae with four dorsal, three external, one ventral, and four to five (one long) internal bristles. *Wings* slightly yellowish, unmarked but sometimes for a very slight shadow round *r-m;* fCu a little after fM. Halteres yellow.

♀ Similar to male, *abdomen* somewhat lighter.

Length of body and wing, 3 mm.

Type: Tahunanui, Nelson (Tonn.), 24th July, 1922, in Cawthron Inst. coll.

Allotype: Otira, 10th Feb., 1922.

Paratypes: Deans Bush, Christchurch, 14th Mar., 1923; Nehotupu, 24th Feb., 1923; Goose Bay, Kaikoura, 4th Feb., 1925; Cass, 20th Feb., 1925; Ohakune, 8th Mar., 1923; Nelson, 20th Sept., 1923.

Specimens in Brit. Mus.: Stewart Is.; Ben Lomond and Queenstown (Curtis); Leith Valley (Howes); Waiho (Tonn.); Ohakune (Harris).

48. **Mycetophila furtiva** n. sp. Tonn.

♀ *Head* brown; palpi dark orange, scape and base of third segment orange, the rest of antennae brown. *Thorax* brown, mesonotum more or less ochreous on sides anteriorly and on both sides of scutellum. *Abdomen* brown, hind-border of segments yellow, genitalia yellowish. *Legs* yellow, tip of hind coxae slightly dark, the extreme tip of hind femora dark. Middle tibiae with four dorsal, two external, one ventral, and five (one long) internal bristles. *Wing* subhyaline with a rather weak central spot on *r-m* and fM; fCu below fM.

Length of body and wing, 2½ mm.

Type: Waiho, 17th Jan., 1922, in Cawthron Inst. coll.

49. **Mycetophila conica** n. sp. Tonn.

♂ *Head* brown; antennae brownish somewhat orange at base, first five joints of flagellum incrassate but gradually decreasing in width

so that the whole antenna, which is not longer than thorax, appears conical; palpi brownish-orange. Mesonotum brownish-orange; pleurae more or less brownish; pteropleurites with three to four bristles. *Abdomen* brown; hypopygium orange. *Legs* entirely yellow. Middle tibiae with four dorsal, two external, one ventral and three (one long) internal bristles. *Wings* greyish, unmarked; fCu under *r-m*. Halteres dark orange.

♀ Somewhat lighter than male on mesonotum and halteres; anal lamellae orange. Antennae short but normal, not conical.

Length of body and wing, 2½ mm.

Type: Dun Mt., Nelson (Tonn.), 5th Jan., 1922.

Allotype: Nelson (Tonn.), 9th Oct., 1923.

Specimens in Brit. Mus.: Queenstown (Curtis); Governors Bay (Tapley).

50. **Mycetophila integra** n. sp. Tonn.

♂ *Head* orange; antennae with yellowish-orange base, brownish from the fourth segment onwards but base of each segment up to ninth or tenth is narrowly orange so that the antennae appear ringed; palpi ornage, last segment darker. *Thorax* yellowish-orange; pteropleurites with four bristles; mesonotum with small dark spot in front of scutellum and above wing-base. *Abdomen* obscure yellow, more brownish towards extremity; hypopygium yellow. Middle tibiae with four dorsal, two external, one ventral and three (one long) internal bristles. *Wings* subhyaline with a hint of a dark shadow on *r-m;* fCu under fM. Halteres yellow.

♀ Similar to male; anal lamellae orange; central wing shadow more distinct.

Length of body and wing, 2½ mm.

Type: Maitai Valley, Nelson, 16th Mar., 1922.

Allotype: *idem.*

Paratypes: *idem* and Nelson, 15th Dec., 1921; Kaikoura, 22nd Feb., 1922; Ohakune, 8th Mar., 1923; Cass, 20th Feb., 1925 (Tonn.).

Specimen in Brit. Mus.: Queenstown (Curtis); Governors Bay (Tapley); Ohakune (Harris).

51. **Mycetophila media** n. sp. Tonn.

♂ *Head* and palpi dark orange; basal third of antennae lighter orange, the rest gradually darker; antennae rather long, segments of flagellum three to four times as long as wide. *Thorax* dark orange, a slight darker streak in front of and on disc of scutellum. Pteropleurite with three to four bristles. *Abdomen* brown. *Legs* completely yellow. Middle tibiae with four dorsal, two external, no ventral and three (all small) bristles. *Wings* yellowish unmarked; fCu below fM. Halteres orange.

♀ Similar to male; venter yellowish, anal lamellae dark,

Length of body 3 mm., wing 3½ mm.

Type: Mt. Arthur (Tonn.), 27th Dec., 1921.

Allotype: *idem.*

Paratypes: *idem* and 21st Dec., 1921; Hilltop, 15th Jan., 1925.

In Brit. Mus.: Ben Lomond (Curtis).

52. **Mycetophila spinigera** n. sp. Tonn. (Fig. 277.)

♂ *Head* orange; palpi brown; antennae with scape and third segment yellow-orange; antennae as long as in the preceding species. *Thorax* bright orange without any dark markings. Pteropleurites with two to three bristles and a few hairs. *Abdomen* brown, lateral and hind-margin of segments yellow. Claspers of hypopygium as in fig. 277. *Legs* completely yellow. Middle tibiae with three to four dorsal and two external bristles, three very small ventral spines and one bristle and two small spine internally. *Wings* yellowish, unmarked. fCu much after fM. Halteres brownish.

♀ Similar to male; size somewhat larger; brown colouration of *abdomen* darker.

Length of body 2½ mm., wing 3 mm.

Type: Mt. Arthur (Tonn.), 26th Dec., 1921, in Cawthron Inst. coll.

Allotype and paratypes: *idem.*

53. **Mycetophila subtenebrosa** n. sp. Tonn.

♂ *Head* and its appendages brownish; basal third of antennae orange. *Thorax* brownish, a small ochreous area on each side of mesonotum posteriorly and on sides of scutellum and postnotum. Pteropleurites with four long bristles. *Abdomen* brown with hind-border of segments narrowly yellow. Hypopygium yellowish. *Legs* entirely yellow. Middle tibiae with dorsal, two external, one ventral and five (two long) internal bristles. *Wings* yellowish, *r-m* and fM darker but no dark shadow on membrane; fCu distinctly after fM. Knob of halteres dark.

Length of body and wing, 3 mm.

Type: Aniseed Valley, Nelson (Tonn.), 4th Dec., 1923, in Cawthron Inst. coll.

Paratype: Cass, Feb., 1925.

54. **Mycetophila harrisi** n. sp. Edw. (Fig. 274.)

Head blackish. Antennae with scape brownish-ochreous, flagellum dark brown, segments about twice as long as broad. Palpi blackish-brown, rather lighter in female. *Thorax* almost uniformly blackish-grey, only sides of scutellum ochreous, bristles black. Three rather short pteropleural bristles, besides a few small hairs. *Abdomen* black, posterior margins of tergites narrowly and indistinctly pale in ♀; anal lamellae of ♀ orange. Hypopygum of the *fungorum* type, claspers narrow, lower division remarkably large and ear-shaped, without spine. *Legs* bright ochreous, coxae and under sides of femora unmarked; hind-femora rather stout and narrowly black at tip. Middle tibiae with four dorsal (five in ♀), two external, four to five very short ventral and three to five internal bristles; ventral bristles placed nearer inner side than usual and perhaps do not correspond to ventral bristles of other species. Hind tibiae with four (♀) or five (♂) external bristles. *Wings* slightly brownish, veins all dark; a small dark cloud over *r-m;* fCu well beyond fM, further in ♂ than in ♀. Halteres yellowish.

Length of body and wing, about 3½ mm.

Type ♂ : Ohakune (T. R. Harris), July-Aug., 1922; allotype ♀, Jan., 1924, in Brit Mus. coll.

This is very much like *M. griseofusca,* differing in hypopygium and chaetotaxy.

55. **Mycetophila intermedia** n. sp. Edw. (Fig. 275.)

♂ Closely resembles *M. harrisi,* differing as follows:—

Wings without dark cloud over *r-m;* fCu below fM. Hypopygium relatively larger; upper claspers broader; lower claspers not so large and provided with two or three blunt spines.

Type: Ohakune (T. R. Harris), May-July, 1923, in Brit. Mus. coll.

This species is somewhat intermediate between *M. harrisi* and *M. griseofusca,* but seems to be quite distinct from both, being much nearer to the former in its chaetotaxy.

56. **Mycetophila tenebrosa** n. sp. Edw.

♀ *Head* blackish, as are antennae and palpi. Flagellar segments fully twice as long as broad. *Thorax* almost wholly blackish-grey, only the sides of scutellum brownish-ochreous. Three fairly well-developed pteropleural bristles. *Abdomen* wholly black, including the rather long and slender anal lamellae. *Legs* rather slender, brownish-ochreous; coxae all more or less darkened outwardly; femora, especially front pair, darkened beneath; tips of hind femora not at all darkened. Middle tibiae with four dorsal, two external, no ventral, and four short internal bristles. Hind-tibiae with four external and three to five small internal bristles. *Wings* rather smoky; a slightly darker cloud over *r-m;* veins all dark; fCu a little beyond fM. Halteres yellowish.

Length of body or wing, 4½ mm.

Type: Ohakune (T. R. Harris), Oct.-Nov., 1923, in Brit. Mus. coll.

The black anal lamellae will distinguish this from most of the other dark-coloured species. *M. nigricans* is rather similar, but has the anal lamellae nearly round, and the hind femora stouter.

36. Genus EPICYPTA Winn.

This genus has been recorded, so far, only from Europe and North America.

The two known New Zealand species can be easily distinguished by their wings: those of *E. immaculata* being completely hyaline and those of *dilata* having conspicuous dark markings and a dilated anal field.

Epicypta immaculata n. sp. Tonn. (Fig. 83.)

♂ *Head* blackish-brown; antennae brown with orange base, segments of flagellum scarcely longer than broad. *Thorax* dark brown, mesonotum shining with anterior part more or less orange also some orange parts around scutellum (mesonotum is often entirely black). *Abdomen* blackish-brown; hypopygium small, orange. Pubescence of body yellowish-brown. *Legs* yellow, tip of hind femora broadly black. Mil-tibiae with four dorsal, three external, two very long ventral, and no internal bristles. Hind-tibiae with bristles irregularly

arranged. *Wings* subhyaline, anterior border slightly yellowish. Costa produced well over tip of R_5 at about the third of distance between R_5 and M_1; fCu below *r-m*. Halteres yellow.

♀ Similar; anal lamellae dark, rather long.

Length of body, 2½ mm.; wing, 3 mm.

Type: Kaikoura (Tonn.), 28th Feb., 1922, in Cawthron Inst. coll.

Allotype: Wellington (Tonn.), 10th Mar., 1923.

Paratypes: Numerous specimens from nearly all parts of N.Z. from Sept. and Apl.

Epicypta dilatata n. sp. Tonn. (Fig. 84.)

♂ *Head* blackish, palpi and basal half of antennae orange, the rest gradually darker; segments of flagellum a little longer than wide. *Thorax* dull blackish-brown, shoulders orange, pubescence yellowish. *Abdomen* dark brown somewhat shining, pubescence of the margin of segments yellowish the rest brown. *Legs* yellowish; tip of posterior coxae, base of all femora below, tip of hind femora and tibiae dark. Middle tibiae with four dorsal, two external, one ventral, and one internal bristles; all these bristles with exception of dorsal ones short. *Wings* with extensive dark markings; the proximal one extends in most of costal cell, a part of basal cell and in base of cell R_1, R_5 and M_2. The whole wing-tip is dark but more intensively near tip of R_5. The two fasciae are connected by a shadow in cell Cu_1 and between Cu_1 and M_4. Anterior part of anal field darkish. Costa produced well beyond tip of R_5, about midway to tip of M_1; R_5 and M_1 strongly divergent. Anal field much dilated although not so much as in *Mycetophila dilatata*. Halteres yellowish white.

Length of body and wing, 2¾ mm.

Type: Reefton (Tonn.), 13th Jan., 1922, in Cawthron Inst. coll.

37. Genus ZYGOMYIA Winn.

This genus, which is very extensively represented in New Zealand is known also from Europe, Canary Is., North America and Australia.

KEY TO SPECIES.

1. Wings clear or with indefinite very slight dark shadow	2.
Wing with distinct and definite dark markings	3.
2. Palpi yellow; pubescence of mesonotum irregularly arranged	1. *immaculata* Tonn.
Palpi dark; pubescence of notum adpressed, regularly arranged	2. *similis* Tonn.
3. Wing tip clear	4.
Wing tip dark	5.
4. Subapical dark band narrower in cell M_2; mesonotum ferrugineous	3. *bifasciata* Tonn.
Subapical dark band of about equal width all through	4. *bivittata* Tonn.
5. Anterior border of the wing completely brown with exception of the very base, this dark colouration extending lower than the costal cell all through	6. *costata* Tonn.
Wings with different markings	6.

6. Distal part of the wing brownish on the anterior part of the membrane only ...... 5. *obsoleta* Tonn.

Distal half of the wing with a distinct shadow on the posterior part of the membrane ...... 7.

7. Distal wing half brownish with or without a clear spot in its middle and if present, this spot not extending in cell R_1 ...... 8.

Distal wing half with a transverse dark band more or less complete and with a dark apex, these two fasciae sometimes united along the hind border of the wing ...... 23.

8. Distal wing half with a more or less large clear spot in this dark area ...... 15.

Distal wing half completely brownish ...... 9.

9. Knob of halteres dark ...... 7. *nigrohalterata* Tonn.

Knob of hatleres yellowish ...... 10.

10. Distal dark marking extending on more than half the wing, especially towards the hind border; rather large dark species ...... 8. *grisescens* Tonn.

Distal dark marking restricted to the apical half of the wing or a little less and well delimited from the basal clear portion of the wing ...... 11.

11. Central dark marking extending below fM towards the hind margin of the wing although sometimes rather faint there ...... 12.

Central dark marking restricted to *r-m* and fM ...... 13.

12. Abdomen with hind margin of segments yellow ...... 9. *ruficollis* Tonn.

Abdomen completely black.

Hypopygium as in fig. 303 ...... 11. *brunnea* Tonn.

Hypopygium as in fig. 302 ...... 10. *nigriventris* Tonn.

13. Halteres with dark knob; thorax completely dark brown ...... 12. *apicalis* Tonn.

Halteres yellow; mesonotum more or less orange...... 14.

14. Thorax mostly orange; 3 external and 2-3 ventral bristles on the middle tibiae ...... 13. *rufithorax* Tonn.

Thorax mostly brownish; 3 external and no ventral bristles on middle tibiae; hypopygium with long lateral lamellae ...... 14. *longicauda* Tonn.

15. Subapical spot small, placed in cell R_5 only or scarcely extending in cell M_2 ...... 16.

Subapical clear spot larger, extending in cell R_5 and M_2 and touching M_1 ...... 18.

16. Halteres with black knob ...... 15. *crassicauda* Tonn.

Halteres entirely yellow ...... 17.

17. Vein R_5 and M_1 arcuate in front of the clear subapical spot. Hypopygium exceedingly large ...... 16. *crassipyga* Tonn.

These veins straight; hypopygium small ...... 17. *guttata* Tonn.

18. Central dark fascia extending against Cu ...... 18. *varipes* Edw.

Central fascia not extending below fM ...... 19.

19. Halteres with black knob; shoulders orange, disc of notum black.

Hypopygium as in fig. 294 ...... 20. *flavicoxa* Marsh.

Hypopygium as in fig. 296 ...... 19. *humeralis* Tonn.

Halteres yellow; colouration of notum different ...... 20.

20.	Mesonotum more or less ferrugineous......	21.
	Mesonotum dark, with or without three darker stripes	22.
21.	Proximal limit of apical dark fascia nearly straight	21. *marginata* Tonn.
	Apical fascia indented in cell M_2	22. *acuta* Tonn.
22.	Mesonotum with three darker bands	23. *albinotata* Tonn.
	Mesonotum with no distinct darker stripes.	
	Hypopygium as in fig. 304	24. *truncata* Tonn.
	Hypopygium as in fig. 293	25. *unispinosa* Tonn.
23.	Middle dark fascia reaching at most as far as M_2 and often not reaching M_1	28. *eluta* Edw.
	Middle dark fascia nearly always reaching the hind border of the wing	24.
24.	Middle dark band narrower than the clear spaces on either sides of it	26. *trifasciata* Tonn.
	Middle dark fascia wider than the clear spaces on either sides	25.
25.	A slight brown shadow in anal field	27. *nigrita* Tonn.
	No distinct shadow in anal field	29. *fusca* Marsh. 30. *distincta* Tonn. 31. *filigera* Edw. 32. *penicillata* Edw.

1. **Zygomyia immaculata** n. sp. Tonn.

♂ *Head* brown; palpi orange; first five antennal segments orange, the rest gradually darker, flagellar segments about twice as long as wide. *Thorax* brown, mesonotum slightly ochreous on sides anteriorly and in front of scutellum; pubescence of disc partly yellowish, partly black, and not arranged regularly. *Abdomen* brown rather dull; *legs* entirely yellow; middle tibiae with four dorsal, three external, three ventral (the middle one longer), and two to three internal bristles. *Wings* greyish somewhat darker anteriorly, unmarked but for a very slight and indistinct shadow on *r-m*. Halteres yellow.

Length of body, 3 mm.; wing, 3½ mm.

Type: Otira (Tonn.), 9th Feb., 1922, in Cawthron Inst. coll.

Paratype: Mt. Arthur (Tonn.), 20th Dec., 1921.

The number of ventral bristles on the middle tibiae is variable.

2. **Zygomyia similis** n. sp. Tonn.

♀ *Head* brown; palpi dark; antennae brown with scape and base of third segment orange. *Thorax* ferrugineous-brown, the notum with slight cinereous reflection and short, equal and regularly arranged pubescence on disc. *Abdomen* brown, lamellae dark. Legs completely yellow; middle tibiae with five dorsal, three external, five ventral (of unequal length), and six internal bristles. *Wings* as in *Z. immaculata,* without markings. Halteres yellow.

Length of body, 3 mm.; wing, 3½ mm.

Type: Waiho (Tonn.), 17th Jan., 1922.

3. **Zygomyia bifasciata** n. sp. Tonn.

♂ *Head* brownish, antennae orange on their first third, then gradually darker, flagellar segments not twice as long as broad; palpi

dark orange. Mesonotum and scutellum dark orange, the rest of thorax brown. *Abdomen* rather shining brown, hypopygium orange; pubescence of body brown. *Legs* entirely yellow; middle tibiae with five dorsal, three external, three ventral, and three internal (one long) bristles. Wings with central fascia on *r-m* and fM not extending in costal cell but prolonged below M_4; a further transverse rather wide band under last part of R_1, this band being only half as wide in cell M_3; apex of wing clear. Halteres yellow.

♀ Similar to male but the two dark fasciae of wings touching along the branches of M; cell M_3 is therefore dark on its first two-third and includes there a small roundish clear spot.

Length of body, 2½ mm.; wing, 3 mm.

Type: Lake Brunner (Tonn.), 5th Feb., 1922, in Cawthron Inst. coll.

Allotype: Maitai Valley, Nelson (Tonn.), 17th Mar., 1922.

Paratypes: Kaikoura, 22nd Feb., 1922; Khandallah, 30th Nov., 1921; Waiho, 30th Jan., 1922 (Tonn.).

Specimens in Brit. Mus.: Ohakune (Harris).

4. **Zygomyia bivittata** n. sp. Tonn. (Fig. 88.)

♂ *Head, thorax* and *abdomen* blackish-brown with slight cinereous reflection in certain positions; pubescence yellowish. The first four segments of antennae orange, the rest gradually darker, flagellar segments about twice as long as wide; palpi orange. *Legs* yellowish; tip of coxae darkish, tip of hind femora rather broadly black, tip of middle femora and posterior tibiae very slightly darkened. Middle tibiae with five dorsal, three external, two to four (only one long) ventral, and two to three internal bristles. *Wings* subhyaline with dark markings as follow: a transverse zig-zag narrow band extending from costa on *r-m*, fM and from there fainter, towards hind-border of wing, a very wide subapical band leaving only tip of cell R_5 and M_3 clear. Sc is rather long and extends to middle of basal cell. Halteres with yellow stem and dark knob.

Length of body, 3 mm.; wing, 3½ mm.

Type: Mt. Arthur, 26th Dec., 1921 (Tonn.), in Cawthron Inst. coll.

Allotype Kaitouna, 19th Feb., 1922.

Specimen in Brit. Mus.: Leith Valley (Howes).

5. **Zygomyia obsoleta** n. sp. Tonn.

♀ *Head, thorax* and *abdomen* completely brown; base of antennae and palpi yellow. Anal lamellae dark. *Legs* entirely yellow. Middle tibiae with four dorsal, two external, one ventral, and one to two internal bristles. *Wing* with dark markings very faint and arranged as follow: one spot on *r-m* and fM and an apical shadow distinct only on anterior border of distal half of wing. Halteres entirely yellow.

This species comes rather near *Z. apicalis* but the markings are much fainter and the apical one does not extend on the posterior half of the wing.

Length of body and wing, 2 mm.

Type: Waiho (Tonn.), 20th Jan., 1922.

6. **Zygomyia costata** n. sp. Tonn.

♀ *Head* and appendages brown; antennae paler at base, segments of flagellum conspicuously shorter than broad, the whole antenna not much longer than head. *Thorax* dull brownish-black, shoulders orange, pubescence of notum yellowish. *Abdomen* rather shining, brownish black pubescence of margin of segments yellow, the rest dark; anal lamellae orange. *Legs* yellow, hind femora broadly black at tip middle tibiae, with four dorsal, two external, two ventral, and one internal bristles. *Wings* rather broad with whole anterior border except the very base uniformly brownish, this shadow extending also on posterior part of distal half of membrane but being there rather faint and including a clear spot in cell R_5 and M_3, this spot not touching vein R_5. *r-m* exceedingly short. Halteres whitish.

Length of body and wing, 2 mm.

Type: Nelson (Tonn.), 1st Nov., 1923, in Cawthron Inst. coll.

7. **Zygomyia nigrohalterata** n. sp. Tonn. (Fig. 292.)

♂ *Head* and appendages brown, base of antennae paler; segments of flagellum about twice as long as broad. *Thorax* dull brown, slightly ferrugineous. *Abdomen* dark brown; hypopygium orange. Pubescence of body dark. *Legs* completely yellow; middle tibiae with four dorsal, three external, four ventral, and five internal (one long) bristles. *Wing* subhyaline with a darkish spot on *r-m* and fM; the apical half of wing uniformly brownish. Halteres with yellow stem and dark knob.

♀ Similar to male; antennae darker at the base; anal lamellae dark.

Length of body and wing, 2½ mm.

Type: Mt. Arthur, Dec., 1921, in Cawthron Inst. coll.

Allotype and paratypes: *idem*.

The chaetotaxy of the middle tibiae is variable; it is sometimes: 4. 2. 3. 4-5.

8. **Zygomyia grisescens** n. sp. Tonn.

♂ *Head* brown, palpi black, rather short; antennae brown with scape orange, segments of flagellum, as an average, three times as long as wide. *Thorax* dull ferrugineous brown with brownish-yellow adpressed regularly arranged pubescence on disc of notum. *Abdomen* brown, hypopygium with two long dorsal lamellae. *Legs* yellowish tip of posterior coxae, base of posterior femora below and tip of posterior tibiae slightly darkened. Middle tibiae with three dorsal, three external, two ventral, and four internal bristles. *Wing* nearly completely smoky with base clear and a clear space after r-m between R_1 and M_3. Halteres yellow.

Length of body, 3¼ mm.; wing, 3¾ mm.

Type: Mt. Arthur (Tonn.), 21st Dec., 1921, in Cawthron Inst. coll.

One specimen in Brit. Mus.: Mt. Grey (Campbell), 23rd Feb., 1924; the formula of the middle tibiae of this specimen is different: 5. 3. 4-5. 4-5., the structure of the hypopygium is, however, exactly similar.

9. **Zygomyia ruficollis** n. sp. Tonn. (Fig. 93.)

♀ *Head* orange basal third of antennae orange, the rest gradually darker, segments of flagellum about twice as long as wide; palpi dark. *Thorax* completely orange-yellow. *Abdomen* brown with hind-border of segments yellow, chiefly on sides; lamellae dark orange. *Legs* yellow, tip of hind tibiae dark. Mid-tibiae with five dorsal, four external three ventral and four internal bristles. *Wing* with a central fascia extending from costa over *r-m,* fM and from there exceedingly faint to posterior margin of wing; apical two-fifth entirely dark but more intensely towards anterior border. Halteres yellow with base of knob dark.

Length of body and wing, 3 mm.

Type: Wellington (Tonn.), 1st Dec., 1921, in Cawthron Inst. coll.

Paratype: Christchurch, Horseshoe Lake (Heighway), 17th Sept., 1924.

10. **Zygomyia nigriventris** n. sp. Tonn. (Fig. 302.)

♂ *Head, thorax* and *abdomen* dark brown; mesonotum somewhat ferrugineous; pubescence dark. Palpi short, brown; antennae moderately long, flagellar segments not twice as long as wide; scape dark orange, the rest dark. Hypopygium according to fig. 302. *Legs* entirely yellow; middle tibiae with five dorsal, two to three external, three ventral, and three to four internal bristles. *Wings* with a transverse zig-zag band from costa across *r-m* and fM to posterior border of wing but much fainter below M_3 apical two-fifth completely brown and more strongly anteriorly. Halteres yellow.

♀ Similar to male, anal lamellae dark.

Length of body, 2 mm.; wing, 2½ mm.

Type: Mt. Arthur, 26th Dec., 1921, in Cawthron Inst. coll.

Allotype and paratypes: *idem.*

11. **Zygomyia brunnea** n. sp. Tonn. (Fig. 303.)

♂ *Head* and appendages brown, antennae scarcely paler at base. *Thorax* brown, mesonotum slightly ferrugineous with cinereous sides in certain light. *Abdomen* brown; hypopygium as in fig. 303. Pubescence of body yellowish. *Legs* yelow, tip of posterior coxae and base of posterior femora below brownish. Middle tibiae with four to five dorsal, two external, two to three ventral and three internal bristles. *Wing* exactly as in the preceding species. Halteres yellow.

♀ Similar to male, anal lamellae dark.

Length of body and wing, 2½ mm.

Type: Mt. Arthur, 22nd Dec., 1922, in Cawthron Inst. coll.

Allotype: *idem.*

Paratypes numerous from many parts of N.Z.

This is one of the most common species of the genus. It can be easily confused with the preceding one from which it differs only by some detail of structure of the hypopygium.

12. **Zygomyia apicalis** n. sp. Tonn.

♂ *Head, thorax* and *abdomen* completely dark brown, the mesonotum a little lighter; pubescence of body dark. Palpi and antennae entirely dark Antennae moderately long, flagellar segments one and

a half times as long as wide. Hypopygium with two rather long hairy inferior appendages. *Legs* entirely yellow. Middle tibiae with five dorsal, two external, three ventral, and four internal bristles. *Wings* with moderately dark brownish markings as follow: a spot on *r-m* and fM, the whole distal half of the membrane dark but more intensively anteriorly. Halteres with yellowish stem and dark knob.

Length of body and wing, 2½ mm.

Type: Waiho (Tonn.), 20th Jan., 1922, in Cawthron Inst. coll.

Paratype: *idem* 30th Jan., 1922.

13. **Zygomyia rufithorax** n. sp. Tonn.

♂ *Head* and appendages brown; base of antennae orange. *Thorax* yellowish-orange with exception of disc of scutellum, middle of postnotum and some parts of pleurae darker. *Abdomen* brown; hypopygium orange. *Leg* yellow entirely; middle tibiae with five dorsal, three external, three ventral, and three to four internal (one long) bristles. *Wing* with a central brownish spot on *r-m* and fM and a dark fascia covering completely distal two-fifths of the membrane which is darker anteriorly. Halteres orange.

♀ Similar to male, anal lamellae more or less orange.

Length of body 2, mm.; wing 2½ mm.

Type: Otira (Tonn.), 10th Feb., 1922, in Cawthron Inst. coll.

Allotype: Mt. Arthur, 21st Dec., 1922.

Paratypes: Mt. Arthur, 24th Dec., 1921; Otira, 10th Feb., 1922; Khandallah, 30th Nov., 1921; Nelson, 12th Dec., 1921; Waiho, 30th Nov., 1922 (Tonn.).

Specimens in Brit. Mus.: Ohakune (Harris); Leith Valley (Howes); Queenstown (Curtis).

14. **Zygomyia longicauda** n. sp. Tonn.

♂ *Head* and appendage brown, base of antennae orange; antennae rather long; flagellar segments twice as long as wide. Mesonotum dark orange, the rest of the *thorax* somewhat darker. *Abdomen* brown, also hypopygium which is provided with rather long lateral lamellae. *Legs* yellow, tip of hind-tibiae brown. Mid-tibiae with four dorsal, two external, no ventral, and three to four internal (all small) bristles. *Wings* as in *rufithorax*. Halteres orange.

Length of body and wing, 2½ mm.

Type: Maitai Valley (Tonn.) 7th Mar., 1922, in Cawthron Inst. coll.

15. **Zygomyia crassicauda** n. sp. Tonn.

♂ *Head* and appendages brown, base of antennae paler. *Thorax* brown, propleurae orange. *Abdomen* brown; hypopygium very large, about one-third of abdomen, much swollen and roundish, its colour dull brown, paler below where there is roundish shining space. *Legs* yellow; middle tibiae with five dorsal, three external, two to three ventral, and two internal bristles. *Wings* with a small central dark spot on *r-m* and fM and a dark apical fascia on the last two within the middle of which there is a small round clear spot in cell R_5 Halteres with yellow stem and black knob.

Length of body, 2 mm.; wing, 2½ mm.

Type: Otira, 10th Feb., 1922 (Tonn.), in Cawthron Inst. coll.

16. **Zygomyia crassipyga** n. sp. Tonn.

♂ *Head* and appendages brown, base of antennae slightly paler. *Thorax* brown, slightly ferrugineous on notum. *Abdomen* brown. Hypopygium very large, about two-fifth of abdomen, brown with yellowish clasper. Pubescence of body dark. *Legs* entirely yellow; middle tibiae with five dorsal, three external, three ventral, and one internal bristles. *Wing* with the central fascia extending from costa on to *r-m* and fM. Apical brown fascia darker anteriorly and with a small round subapical clear spot in cell R_5, the space between this spot and wing-tip not being as dark as the rest of the fascia. Veins R_5 and M_1 somewhat arcuate in front of the little subapical clear spot. Halteres yellow.

♀ Base of antennae and mesonotum someyhat paler. Tip of posterior coxae, base of posterior femora and hind knees slightly dark. Anal lamellae dark.

Length of body, 2 mm.; wing, $2\frac{1}{2}$ mm.

Type: Waiho (Tonn.), 28th Jan., 1922, in Cawthron Inst. coll.

Allotype: Kaikoura, 23rd Feb., 1922.

Paratype: Otira, 10th Feb., 1922.

Specimen in Brit. Mus.: Ohakune (Harris).

17. **Zygomyia guttata** n. sp. Tonn.

♂ *Head* and appendages brown, antennae slightly paler at base, moderately long, the flagellar segments scarcely longer than wide. *Thorax* brown, sides of mesonotum slightly greyish. *Abdomen* brown; hypopygium very small. *Legs* yellow, posterior coxae and femora slightly and narrowly darkened at tip, extremity of posterior tibiae distinctly darkened; middle tibiae with five dorsal, three external, three ventral and one to two internal bristles. *Wing* with central dark fascia extending from costa on to *r-m* and stem of M but scarcely on fM; apical fascia on distal two-fifth of wing, conspicuously darker anteriorly and with a roundish clear spot in middle of cell R_5, this spot extending slightly and inconspicuously in cell M_3. Halteres yellowish-white.

Length of body, $1\frac{3}{4}$ mm.; wing, 2 mm.

Type: Nelson (Tonn.), 4th Mar., 1922, in Cawthron Inst. coll.

18. **Zygomyia varipes** n. sp. Edw.

♀ *Head* blackish-grey, with black bristles and pale pubescence. Antennae black, scape hardly lighter; flagellar segments about half as long again as broad. Palpi brownish. *Thorax* blackish-brown, slightly dusted with grey, shoulders narrowly ochreous; bristles black, pubescence pale. Three strong pteropleural bristles. *Abdomen* blackish somewhat shining, anal lamellae small and dark. *Legs* ochreous; all coxae with distinct black marks on outer side at tip; front femora dark beneath; posterior femora with about the basal and apical thirds black; hind tibiae black at tip. Middle tibiae with four dorsal, three external, one ventral, and two internal bristles. *Wings* with the ground-colour clear; a well-marked dark band extending from costa, where it is broadest, through base of cell M_1 to Cu,

above which it again broadens towards base of wing; tip broadly dark, including a clear spot which just touches R_5 and M_3 and is slightly constricted at M_1. Halteres white.

Length of body or wing, 3 mm.

Type: Queenstown (L. Curtis), 25th Mar., 1923, in Brit. Mus. coll.

19. **Zygomyia humeralis** n. sp. Tonn. (Fig. 296.)

♂ *Head* brown; palpi yellow; antennae brown with orange scape. *Thorax* dull blackish-brown with anterior corners of mesonotum orange and its side greyish; its pubescence rather long, yellowish. *Abdomen* shining dark brown; hypopygium as in fig. 296. *Legs* yellow; tip of hind-femora broadly dark; mid-tibiae with four dorsal, three external, one ventral, and two internal bristles. *Wing* with a dark marking on *r-m* and fM; the whole of costal cell but its base darkish; distal half of wing dark with a clear spot in cells R_5 and M_3, this spot not touching vein R_5. Halteres with yellow stem and black knob.

♀ Similar to male; size somewhat larger. Anal lamellae orange.

Length of body and wing, 1¾ mm.

Type: Nelson (Tonn.), 13th Oct., 1923, in Cawthron Inst. coll.

Allotype: Kaikoura, 22nd Feb., 1922.

Paratypes: Cass, 27th Nov., 1924; Christchurch, 17th Dec., 1924; Nelson, 1st Sept., 1923; and 15th Dec., 1921.

The antennae are sometimes completely dark.

20. **Zygomyia flavicoxa** Marsh. (Figs. 90, 294.)

Marshal, *Trans N.Z. Inst,* 28, 1896, p. 297.

This species and the preceding one are scarcely distinguishable but by the structure of the male's hypopygium. Fig. 294 is made after the hypopygium of the type.

Besides Wanganui and Lincoln, this species is known from Ohakune (Harris); Governors Bay (Tapley); Christchurch (Campbell).

21. **Zygomyia marginata** n. sp. Tonn.

♂ *Head* brown; palpi dark orange; antennae brown with paler base, their length moderate, flagellar segments only a little longer than wide. *Thorax* brown, mesonotum somewhat paler with some cinereous reflections in certain positions. Abdomen brown; hypopygium with dorsal lamellae rounded on the outside and pointed at tip. *Legs* entirely yellow; mid-tibiae with five dorsal, three external, two ventral, and one internal bristles. *Wing* with a rather large central fascia on *r-m* and fM and extending against costa; apical fascia darker on anterior border and with a clear spot in middle across the cells R_5 and M_3. Halteres yellow.

♀ Similar to male; anal lamellae dark.

Length of body and wing, 2½ mm.

Type: Otira, 10th Feb., 1922 (Tonn.), in Cawthron Inst. coll.

Allotype: Nelson (Tonn), 27th June, 1922.

Paratypes: Otira, 10th Feb., 1922; Lake Brunner, 4th Feb., 1922; Nelson, 27th June, 1922.

Specimens in Brit. Mus.: Ohakune (Harris); Governors Bay (Tapley); Queenstown (Curtis).

22. **Zygomyia acuta** n. sp. Tonn. (Fig. 85.)

Very similar to *Z. marginata* from which it differs chiefly by the hypopygium, the superior lamellae being fusiform, acute at apex which carries a bristle. Mesonotum paler. Middle tibiae with five dorsal, three external, three ventral, and three internal (one long) bristles. The first half of cell M_3 is clear, the limit of apical dark fascia is therefore in that cell not on the same level as that of the cells above and below as it is the case in *Z. marginata* and the allied species. Female with dark anal lamellae.

Type: Waiho (Tonn.), 30th Jan., 1922, in Cawthron Inst. coll.

Allotype: *idem.*

23. **Zygomyia albinotata** n. sp. Tonn. (Fig. 92.)

♂ *Head* and its appendages brown; antennae slightly lighter at base; flagellar segments as an average not twice as long as wide. *Thorax* brown with a slight grey pruinosity; mesonotum with three darker stripes not distinct in all positions and more or less fused together. *Legs* yellow, tip of posterior coxae and base of posterior femora below dark; tip of hind-femora and tibiae darkened. Mid-tibiae with four dorsal, three external one to two ventral and three to four (one long) internal bristles. *Wing* with a rather large central dark fascia on *r-m* and fM and extending on costa; apical fascia darker anteriorly and with a clear space in middle of cells R_5 and M_3. Halteres yellow.

♀ Similar to male; anal lamellae dark orange.

Length of body and wing 2½ mm.

Type: Mt. Arthur (Tonn.) 22nd December, 1921. In Cawthron Inst. coll.

Allotype and paratypes: *idem.*

24. **Zygomyia truncata** n. sp. Tonn. (Fig. 304.)

Very closely related to *Z. albinotata* from which it differs mainly in the hypopygium, the superior lamellae of which is shown in Fig. 304. Middle tibiae with four dorsal, two external, two ventral, and two to three internal bristles.

Type: Mt. Arthur (Tonn.), 26th Dec., 1921, in Cawthron Inst. coll.

Allotype: Dun Mount., Nelson (Tonn.), 5th Feb., 1922.

25. **Zygomyia unispinosa** n. sp. Tonn. (Fig. 293.)

Very similar to *Z. albinotata* for size and colouration as well as for wing-pattern, but there is no distinct stripes on mesonotum. The middle tibiae carry only one ventral bristles. By the shape of the superior lamellae of the hypopygium it comes nearer to *Z. marginata* from which it differs, however, by the larger size, the colouration of the *legs* and by the larger subapical clear spot of the wing.

Length of wing and body, 3 mm.

Type: Mt. Arthur, 21st Dec., 1921 (Tonn.), in Cawthron Inst. coll.

Paratype: one male *idem.*

26. **Zygomyia trifasciata** n. sp. Tonn. (Fig. 94.)

♂ *Head* and appendages dark; antennae lighter at base, flagellar segments twice as long as wide. *Thorax* ferrugineous-brown. *Abdomen* brown, hind-border of segments slightly yellowish. *Legs* yellow; middle tibiae with four dorsal, three external, two ventral and two to four internal bristles. *Wing* with a central spot on *r-m* and fM and a dark tip; midway between these two dark fasciae there is a rather narrow transverse dark band from R_1 to M, the clear spaces on each side being wider than the dark band itself. Halteres with a darkish knob.

Length of body and wing, 2½ mm.

Type: Dun Mt., Nelson (Tonn.), 5th Jan., 1922, in Cawthron Inst. coll.

27. **Zygomyia nigrita** n. sp. Tonn. (Fig. 289.)

♂ *Head* and body completely dark; palpi and antennae brown, base of antennae slightly lighter; mesonotum dull with greyish reflection. Pubescence of body yellowish. *Legs* yellow, tip of all coxae base of posterior femora below and tip of hind-tibiae darkened. Midtibiae with four dorsal, three external, two ventral, and three internal bristles. *Wing* with a central spot on *r-m* and fM; a very slight shadow in anal field at level of fM; a transverse band between third fifth and second third of wing, darker anteriorly; last quarter of wing dark, this last fascia separated from preceding one by a transverse clear band which does not quite reach posterior border. Halteres yellow.

♀ Similar to male; anal lamellae dark orange.

Length of body and wing, 2½ mm.

Type: Tahunanui, Nelson (Tonn.), 21st July, 1922, in Cawthron Inst. coll.

Allotype: *idem.*

Paratypes: Nelson, 28th Sept., 1923 and 9th Oct., 1923.

28. **Zygomyia eluta** n. sp. Edw. (Figs. 95, 295.)

Head blackish, as are palpi and antennae, the latter only slightly brownish at base; flagellar segments about half as long as broad. *Thorax* uniformly blackish-grey; hair brownish; bristles black; three strong propleural and two pteropleural bristles. *Abdomen* blackish, with scanty pale hair; hind margins of segments narrowly pale; hypopygium small and hidden. *Legs* ochreous, tarsi and spurs dark; coxae unmarked; middle tibiae with three to four dorsal, two to three external, one ventral and two to three small internal bristles; bristles beneath first hind tarsal segment very little longer than the diameter of the segment. *Wing* mainly clear; a slight dark seam over *r-m* and stem of median fork; a narrow and faint brownish band from costa a short distance before tip of R_1, reaching at most as far as M_3, but often not reaching M_1; tip of wing slightly darkened. Venation normal; Sc short. Halteres yellow.

Length of body, 2½-3 mm.; wing, 2½-3 mm.

Type ♂: Governors Bay (J. F. Tapley), in Brit. Mus. coll.; and numerous paratypes ♂ ♀, Aug.-Sept., 1922; Queenstown (L. Curtis); 1 ♂ 2 ♀, 10th Sept., 1923; Ohakune (T. R. Harris); 1 ♂, Aug., 1922.

29. **Zygomyia fusca** Marsh. (Figs. 87, 290, 291.)
Marshall, *Trans N.Z. Inst.*, 28, 1896, p. 298.

A drawing of the type's hypopygium is given in figs. 290-91.

The type's locality is not known, but this species which is not uncommon has been collected again at: Queenstown (Curtis); Governors Bay (Tapley); Ohakune (Harris); Maitai Valley, Nelson (Tonn.), 22nd Mar., 1922; Lake Brunner, 2nd Feb., 1922.

30. **Zygomyia distincta** n. sp. Tonn. (Fig. 298.)

♂ *Head* and appendages brown, base of antennae slightly lighter. *Thorax* brown pubescence rather shaggy on disc of mesonotum. *Abdomen* brown; hypopygium as in fig. 298. *Legs* entirely yellow; mid-tibiae with four dorsal, three external, one ventral, two to three internal bristles. *Wing* with a small darkish spot on *r-m* and fM, not extending to the costa; a rather wide transverse band from tip of R_1 to hind-border which is united there to dark apical fascia. Halteres yellow.

♀ Similar to male, the two dark fasciae of the last half of the wing not, or scarcely, united along the hind-border.

Length of body, 2¼ mm.; wing, 2¾ mm.

Type: Waiho 17th Jan., 1922 (Tonn.), in Cawthron Inst. coll.

Allotype: Purau Creek (Tonn.), 20th Feb., 1922.

31. **Zygomyia filigera** n. sp. Edw. (Fig. 300.)

Closely resembles *Z. fusca* Marshall in colour and chaetotaxy, differing as follows:—

Average size a little larger. Antennae rather longer, the flagellar segments in male over twice as long as broad. *Thorax* with a more distinct reddish tinge. Male claspers much longer and more slender, fully as long as the combined length of fifth and sixth abdominal segments.

Type ♂ : Ohakune (T. R. Harris), in Brit. Mus. coll.; paratypes *idem* 3 ♂ 2 ♀, Sept., 1922; May-July, 1923; and Oct.-Nov., 1923.

32. **Zygomyia penicillata** n. sp. Edw. (Fig. 301.)

♂ Closely resembles *Z. fusca* differing only in the details of structure of the hypopygium; chiefly in the form of the claspers, which are stouter and quite straight, bearing a denser branch of hairs.

Type: Governors Bay (J. F. Tapley), 15th Aug., 1923, in Brit. Mus. coll.; paratype ♂ : *idem*, Dec., 1923.

EXPLANATION OF PLATES.

FIG. 1.—*Centrocnemis basalis* Tonn.
FIG. 2.—*Centrocnemis tillyardi* Tonn.
FIG. 3.—*Centrocnemis nitida* Tonn.
FIG. 4.—*Nervijuncta osten-sackeni* Tonn.
FIG. 5.—*Nervijuncta marshalli* Edw.
FIG. 6.—*Nervijuncta marshalli* (variety).
FIG. 7.—*Nervijuncta punctata* Tonn.
FIG. 8.—*Nervijuncta filicornis* Edw.
FIG. 9.—*Nervijuncta nigricornis* Tonn.
FIG. 10.—*Nervijuncta ruficeps* Edw.
FIG. 11.—*Nervijuncta hudsoni* Marsh.
FIG. 12.—*Nervijuncta wakefieldi* Edw., large male
FIG. 13.—*Nervijuncta wakefieldi* Edw., small male
FIG. 14.—*Nervijuncta flavoscutellata* Tonn., large male
FIG. 15.—*Nervijuncta flavoscutellata* Tonn., small male
FIG. 16.—*Nervijuncta longicauda* Edw.
FIG. 17.—*Nervijuncta pulchella* Edw.

FIG. 18.—*Nervijuncta hexachaeta* Edw.
FIG. 19.—*Nervijuncta tridens* Hutton.
FIG. 20.—*Nervijuncta bicolor* Edw.
FIG. 21.—*Nervijuncta nigrescens* Marsh.
FIG. 22.—*Heterotricha novae-zealandiae* Tonn.
FIG. 23.—*Arachnocampa luminosa* Skuse.
FIG. 24.—*Macrocera pulchra* Tonn.
FIG. 25.—*Macrocera montana* Marsh.
FIG. 26.—*Macrocera scoparia* Marsh.
FIG. 27.—*Macrocera ngairae* Edw.
FIG. 28.—*Macrocera hudsoni* Tonn.
FIG. 29.—*Macrocera unipunctata* Tonn.
FIG. 30.—*Macrocera fenestrata* Edw.
FIG. 31.—*Macrocera milligani* Tonn.
FIG. 32.—*Paramacrocera brevicornis* Edw.
FIG. 33.—*Cerotelion bimaculatus* Tonn.

FIG. 34.—*Cerotelion hudsoni* Marsh.
FIG. 35.—*Cerotelion leucoceras* Marsh.
FIG. 36.—*Platyura maculipennis* Tonn.
FIG. 37.—*Platyura punctifusa* Edw.
FIG. 38.—*Platyura lamellata* Tonn.
FIG. 39.—*Platyura exigua* (var.) Tonn.
FIG. 40.—*Platyura campbelli* Tonn.
FIG. 41.—*Platyura harrisi* Edw.
FIG. 42.—*Sciara nubeculosa* Edw.
FIG. 43.—*Sciara annulata* Mg.
FIG. 44.—*Scythroprochroa* nitida Edw.
FIG. 45.—*Ohakunea bicolor* Edw.
FIG. 46.—*Mycomyia flavilatera* Tonn.
FIG. 47.—*Mycomyia furcata* Edw.
FIG. 48.—*Taxicnemis hirta* Marsh.
FIG. 49.—*Aneura fusca* Tonn.

FIG. 50.—*Aneura bispinosa* Edw.
FIG. 51.—*Aneura longicauda* Tonn.
FIG. 52.—*Aneura boletinoides* Marsh.
FIG. 53.—*Parvicellula ruficoxa* Tonn.
FIG. 54.—*Parvicellula fascipennis* Edw.
FIG. 55.—*Synapha apicalis* Tonn.
FIG. 56.—*Synapha parva* Edw.

FIG. 57.—*Allocotocera cephasi* Edw.
FIG. 58.—*Allocotocera dilatata* Tonn.
FIG. 59.—*Phthinia longiventris* Tonn.
FIG. 60.—*Aphelomera skusei* Marsh.
FIG. 61.—*Neotrizygia obscura* Tonn.
FIG. 62.—*Paracycloneura apicalis* Tonn.
FIG. 63.—*Cycloneura flava* Marsh.
FIG. 64.—*Cycloneura aberrans* Tonn.
FIG. 65.—*Sygmolea melanoxantha* Edw.

FIG. 66.—*Anomalomyia guttata* Hutt., pale variety.
FIG. 67.—*Anomalomyia guttata* Hutt., dark variety.
FIG. 68.—*Anomalomyia viatoris* Edw.
FIG. 69.—*Anomalomyia minor* Marsh., pale wing.
FIG. 70.—*Anomalomyia affinis* Tonn.
FIG. 71.—*Paradoxa fusca* Marsh.
FIG. 72.—*Cawthronia nigra* Tonn.
FIG. 73.—*Paracycloneura apicalis* Tonn.
FIG. 74.—*Morganiella fusca* Tonn.
FIG. 75.—*Tetragoneura rufipes* Tonn.
FIG. 76.—*Tetragoneura fusca* Tonn.
FIG. 77.—*Tetragoneura spinipes* Edw.
FIG. 78.—*Trichoterga monticola* Tonn.
FIG. 79.—*Exechia filata* Edw.
FIG. 80.—*Exechia hiemalis* Marsh.
FIG. 81.—*Allodia fragilis* Marsh.

FIG. 82.—*Allodia maculata* Tonn.
FIG. 83.—*Epicypta immaculata* Tonn.
FIG. 84.—*Epicypta dilatata* Tonn.
FIG. 85.—*Manota maorica* Edw.
FIG. 86.—*Zygomyia acuta* Tonn.
FIG. 87.—*Zygomyia fusca* Marsh.
FIG. 88.—*Zygomyia bifasciata* Tonn.
FIG. 89.—*Zygomyia bivittata* Tonn.
FIG. 90.—*Zygomyia flavicoxa* Marsh.
FIG. 91.—*Zygomyia sp. inc.*
FIG. 92.—*Zygomyia albonotata* Tonn.
FIG. 93.—*Zygomyia ruficollis* Tonn.
FIG. 94.—*Zygomyia trifasciata* Tonn.
FIG. 95.—*Zygomyia eluta* Edw.
FIG. 96.—*Mycetophila ornatissima* Tonn.
FIG. 97.—*Mycetophila latifascia* Edw.
FIG. 98.—*Mycetophila nitens* Tonn.
FIG. 99.—*Mycetophila marshalli* End.

FIG. 100.—*Mycetophila marshalli* variety.
FIG. 101.—*Mycetophila consobrina* Tonn.
FIG. 102.—*Mycetophila griscescens* Tonn.
FIG. 103.—*Mycetophila diffusa* Tonn.
FIG. 104.—*Mycetophila similis* Tonn.
FIG. 105.—*Mycetophila curtisi* Edw.
FIG. 106.—*Mycetophila sylvatica* Tonn.
FIG. 107.—*Mycetophila virgata* Tonn.
FIG. 108.—*Mycetophila elegans* Tonn.
FIG. 109.—*Mycetophila phyllura* Edw.
FIG. 110.—*Mycetophila howletti* Marsh.
FIG. 111.—*Mycetophila vulgaris* Tonn.
FIG. 112.—*Mycetophila elongata* Tonn.
FIG. 113.—*Mycetophila marginepunctata*, var. *ruapehuensis* Edw.

FIG. 114.—*Mycetophila marginepunctata* Tonn.
FIG. 115.—*Mycetophila marginepunctata*, var. *rotundipennis* Edw.
FIG. 116.—*Mycetophila variabilis* Marsh.
FIG. 117.—*Mycetophila colorata* Tonn.

FIG. 118.—*Mycetophila fumosa* Tonn.
FIG. 119.—*Mycetophila dilatata* Tonn.
FIG. 120.—*Neopnyxia nelsoniana* Tonn., from the side.
FIG. 121.—*Neopnyxia nelsoniana* Tonn., from above.
FIG. 122.—*Neopnyxia nelsoniana* Tonn., integuments strongly magnified.

FIG. 123.—*Centrocnemis fumipennis* Tonn., Hypopygium, left apical half.

FIG. 124.—*Centrocnemis tillyardi* Tonn., Hypopygium, left apical half.
FIG. 125.—*Centrocnemis fumipennis* Tonn., Hypopygium, from the side.
FIG. 126.—*Centrocnemis tillyardi* Tonn., Hypopygium, from the side.
FIG. 127.—*Centrocnemis trivittata* Edw., Hypopygium (half), from beneath.
FIG. 128.—*Centrocnemis trivittata* Edw., Hypopygium, from the side.
FIG. 129.—*Centrocnemis basalis* Tonn., Hypopygium, from the side.
FIG. 130.—*Centrocnemis basalis* Tonn., Hypopygium, tip of internal clasper.
FIG. 131.—*Centrocnemis nitida* Tonn., Hypopygium, from the side.
FIG. 132.—*Centrocnemis nitida* Tonn., Hypopygium (half), from beneath.
FIG. 133.—*Nervijuncta osten-sackeni* Tonn., clasper from beneath.
FIG. 134.—*Nervijuncta flavoscutellata* Tonn., hypopygium from the side.
FIG. 135.—*Nervijuncta punctata* Tonn., hypopygium from above.
FIG. 136.—*Nervijuncta nigrescens* Marsh., hypopygium from above.

FIG. 137.—*Nervijuncta ruficeps* Edw., hypopygium from the side.
FIG. 138.—*Nervijuncta ruficeps* Edw., inside of clasper at base.
FIG. 139.—*Nervijuncta longicauda* Edw., hypopygium from the side.
FIG. 140.—*Nervijuncta wakefieldi* Edw., hypopygium (half) from above.
FIG. 141.—*Nervijuncta wakefieldi* variety, hypopygium (half) from above.
FIG. 142.—*Nervijuncta wakefieldi* variety, clasper.
FIG. 143.—*Nervijuncta hexachaeta* Edw., hypopygium from the side.
FIG. 144.—*Nervijuncta hexachaeta* Edw., inside of clasper.
FIG. 145.—*Nervijuncta tridens* Hutt., hypopygium (half) from above.
FIG. 146.—*Nervijuncta harrisi* Edw., hypopygium from the side.
FIG. 147.—*Nervijuncta harrisi* Edw., inside of clasper.

FIG. 148.—*Nervijuncta hudsoni* Marsh., hypopygium from the side.
FIG. 149.—*Nervijuncta nigricoxa* Edw., hypopygium (half) from above.
FIG. 150.—*Nervijuncta nigricoxa* Edw., clasper.
FIG. 151.—*Nervijuncta bicolor* Edw., hypopygium (half) from above
FIG. 152.—*Nervijuncta bicolor* Edw., clasper.
FIG. 153.—*Nervijuncta parvicauda* Edw., hypopygium from above.
FIG. 154.—*Arachnocampa luminosa* Skuse, hypopygium from below.
FIG. 155.—*Cerotelion bimaculatus* Tonn., hypopygium from the side.
FIG. 156.—*Cerotelion bimaculatus* Tonn., hypopygium from above.
FIG. 157.—*Cerotelion niger* Tonn., clasper.
FIG. 158.—*Cerotelion leucoceras* Marsh., clasper.

FIG. 159.—*Platyura subbrevis* Tonn., hypopygium from above.
FIG. 160.—*Platyura brevis* Tonn., hypopygium from above.
FIG. 161.—*Platyura lamellata* Tonn., hypopygium from the side.
FIG. 162.—*Platyura proxima* Tonn., hypopygium from the side.
FIG. 163.—*Platyura marshalli* Tonn., hypopygium from the side.
FIG. 164.—*Platyura brookesi* Edw., hypopygium from the side.
FIG. 165.—*Platyura punctifusa* Edw., hypopygium from above.

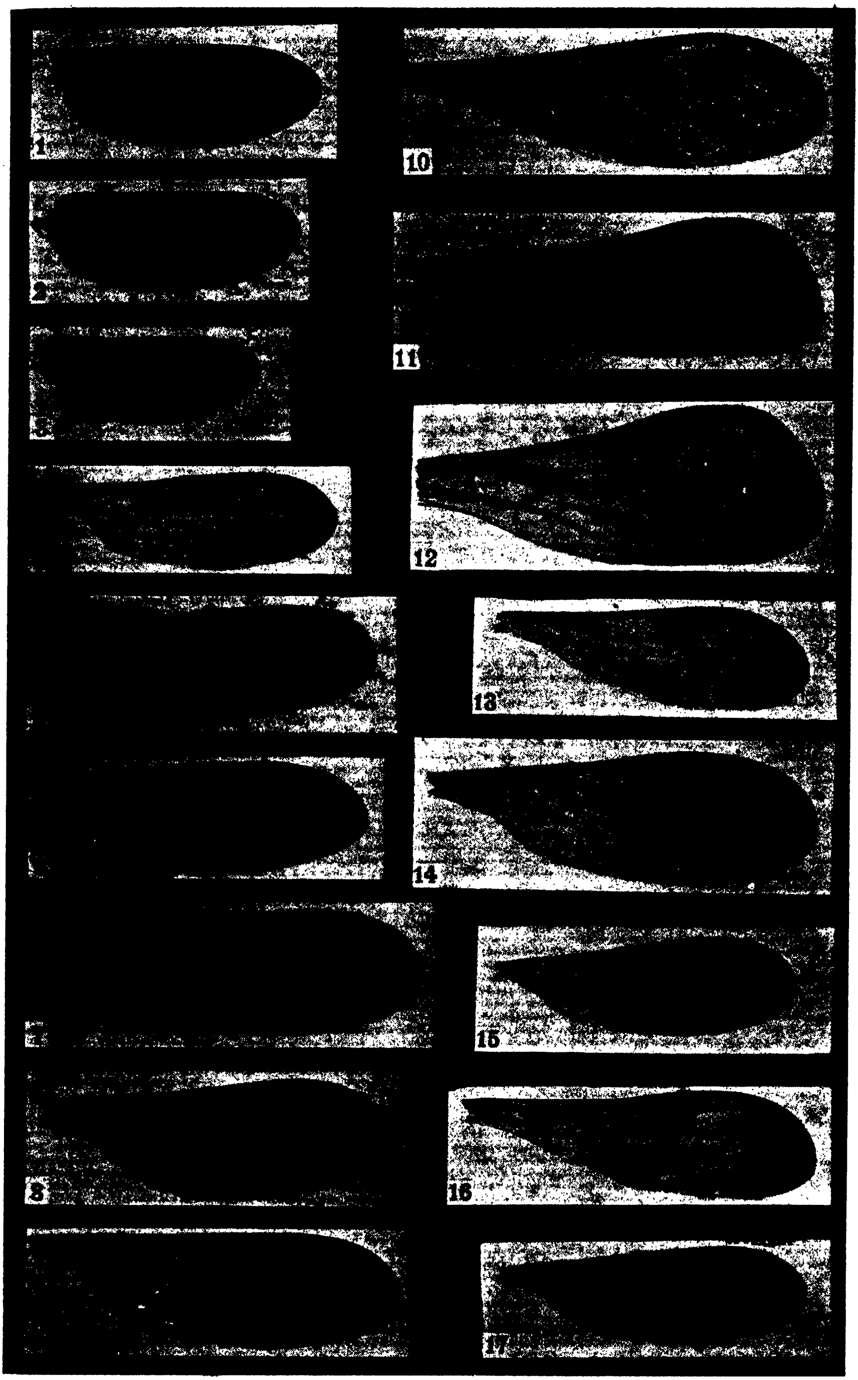
Fig. 166.—*Mycomyia plagiata* Tonn., hypopygium (half) from above.
Fig. 167.—*Mycomyia plagiata* Tonn., hypopygium (half) from beneath.
Fig. 168.—*Mycomyia furcata* Edw., hypopygium (half) from above.
Fig. 169.—*Mycomyia furcata* Edw., hypopygium (half) from beneath.
Fig. 170.—*Mycomyia furcata* Edw., clasper.
Fig. 171.—*Mycomyia flavilatera* Tonn., hypopygium (half) from above.
Fig. 172.—*Mycomyia flavilatera* Tonn., hypopygium from beneath.

Fig. 173.—*Sciara rufulenta* Edw., clasper.
Fig. 174.—*Sciara rufulenta* variety, clasper.
Fig. 175.—*Sciara vicarians* Edw., clasper.
Fig. 176.—*Sciara ovalis* Edw., clasper.
Fig. 177.—*Sciara constrictans* Edw., clasper.
Fig. 178.—*Sciara agraria* Felt., clasper.
Fig. 179.—*Sciara agraria* Felt., clup of hairs.
Fig. 180.—*Sciara zealandica* Edw., clasper.
Fig. 181.—*Sciara jejuna* Edw., clasper.
Fig. 182.—*Sciara annulata* Mg., clasper.
Fig. 183.—*Sciara nubeculosa* Edw., clasper.
Fig. 184.—*Sciara sp. inc.*, clasper.
Fig. 185.—*Sciara marcilla* Hutt., clasper.
Fig. 186.—*Sciara tapleyi* Edw., clasper.
Fig. 187.—*Sciara harrisi* Edw., clasper.
Fig. 188.—*Sciara griseinervis* Edw., clasper.
Fig. 189.—*Sciara philpotti* Tonn., hypopygium (half) from above.
Fig. 190.—*Ohakunea bicolor* Edw., tergite of hypopygium.
Fig. 191.—*Ohakunea bicolor* Edw., claspers.

Fig. 192.—*Neopnyxia nelsoniana* Tonn., middle leg.
Fig. 193.—*Neopnyxia nelsoniana* Tonn., hind leg.
Fig. 194.—*Neopnyxia nelsoniana* Tonn., front leg.
Fig. 195.—*Taxicnemis flava* Marsh., hypopygium (half) from above.
Fig. 196.—*Taxicnemis flava* Marsh., clasper.
Fig. 197.—*Taxicnemis flava* Marsh., side piece from beneath.
Fig. 198.—*Allocotocera anaclinoides* Marsh., hypopygium from beneath.
Fig. 199.—*Aneura fagi* Marsh., hypopygium from beneath (half).
Fig. 200.—*Aneura longipalpis* Tonn., hypopygium from beneath (half)
Fig. 201.—*Aneura bispinosa* Edw., hypopygium from beneath (half)
Fig. 202.—*Aneura boletinoides* Marsh., hypopygium from beneath (whole).
Fig. 203.—*Aneura fusca* Tonn., hypopygium from beneath (half).
Fig. 204.—*Aneura filiformis* Tonn., hypopygium from beneath (half).

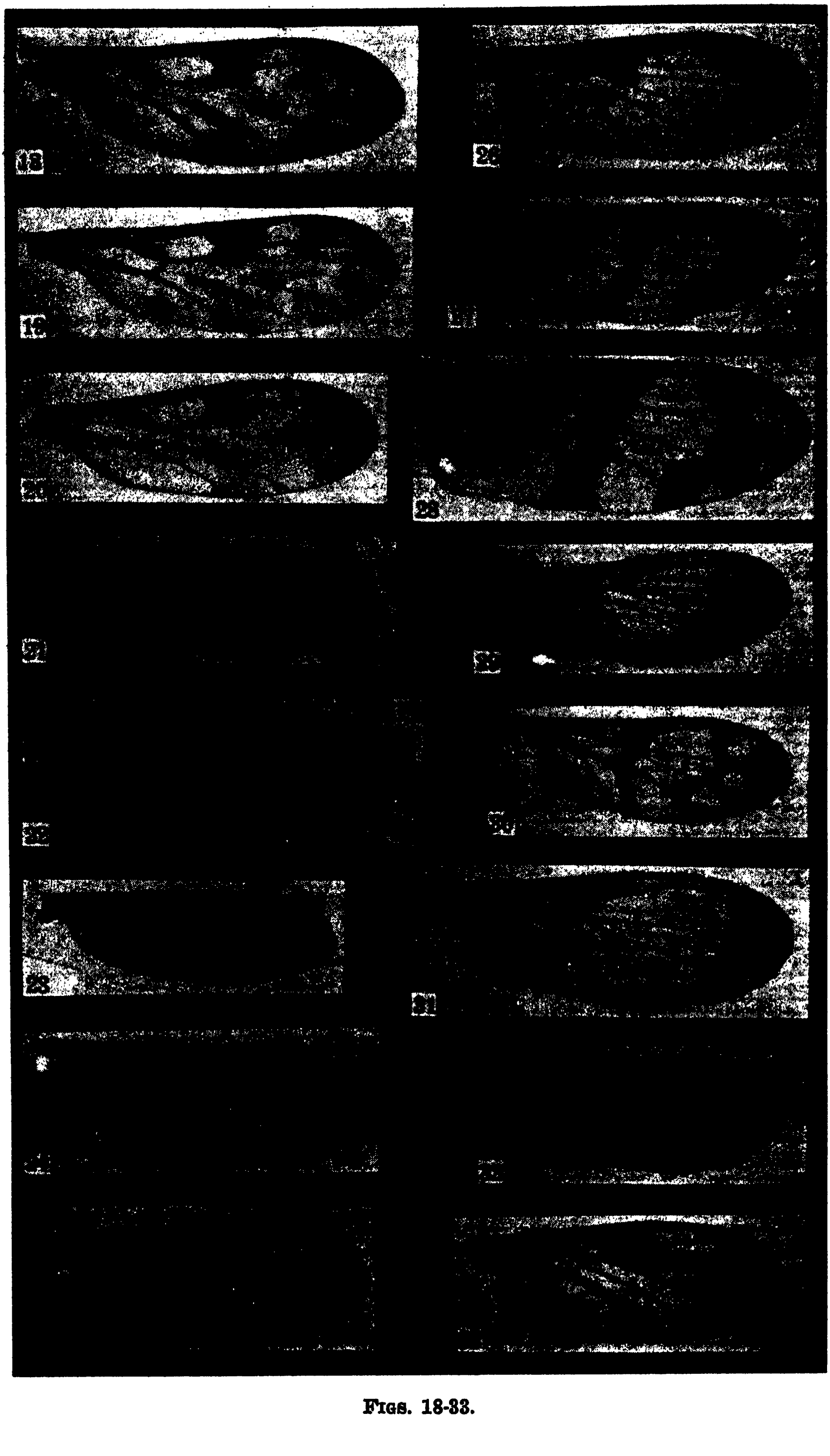
Fig. 205.—*Aneura pallida* Edw., hypopygium from beneath (half).
Fig. 206.—*Aneura longicauda* Tonn., hypopygium from the side.
Fig. 207.—*Aneura appendiculata* Tonn., hypopygium from beneath (half).
Fig. 208.—*Parvicellula hamata* Edw., inner clasper.
Fig. 209.—*Parvicellula hamata* Edw., hypopygium from above (half).
Fig. 210.—*Parvicellula nigricoxa* Tonn., hypopygium from above (half).
Fig. 211.—*Parvicellula gracilis* Tonn., hypopygium from above.
Fig. 212.—*Parvicellula triangula* Marsh., hypopygium from above.
Fig. 213.—*Parvicellula apicalis* Tonn., hypopygium from above.
Fig. 214.—*Parvicellula ruficoxa* Tonn., hypopygium from above.
Fig. 215.—*Parvicellula subhamata* Tonn., hypopygium from above.
Fig. 216.—*Aneura nitida* Tonn., hypopygium from beneath (half).

Fig. 217.—*Aphelomera forcipata* Edw., hypopygium from above.
Fig. 218.—*Aphelomera forcipata* Edw., hypopygium, sternal plate.
Fig. 219.—*Aphelomera marshalli* Edw., hypopygium from above.
Fig. 220.—*Aphelomera marshalli* Edw., hypopygium, sternal plate.

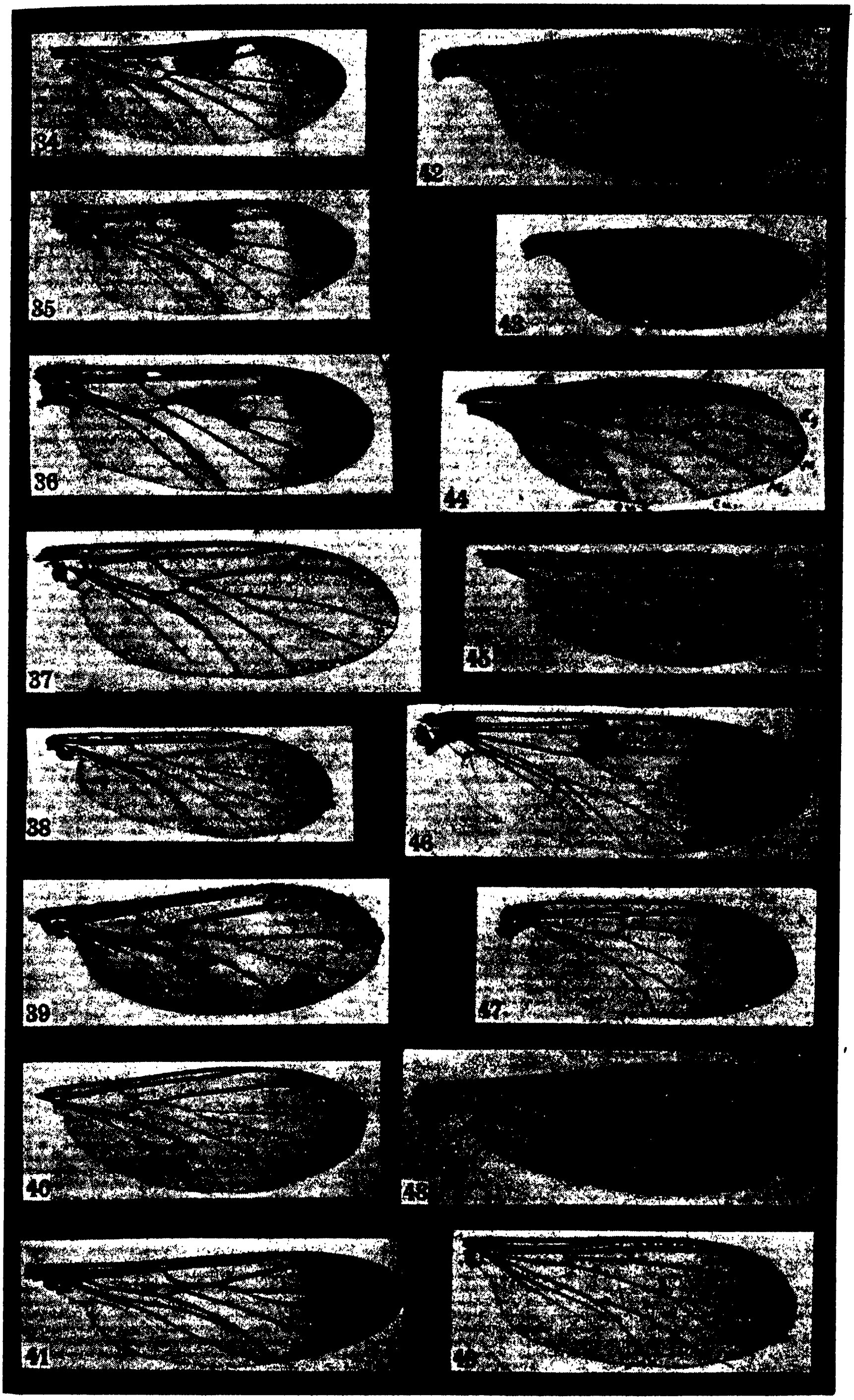


Figs. 1-17.

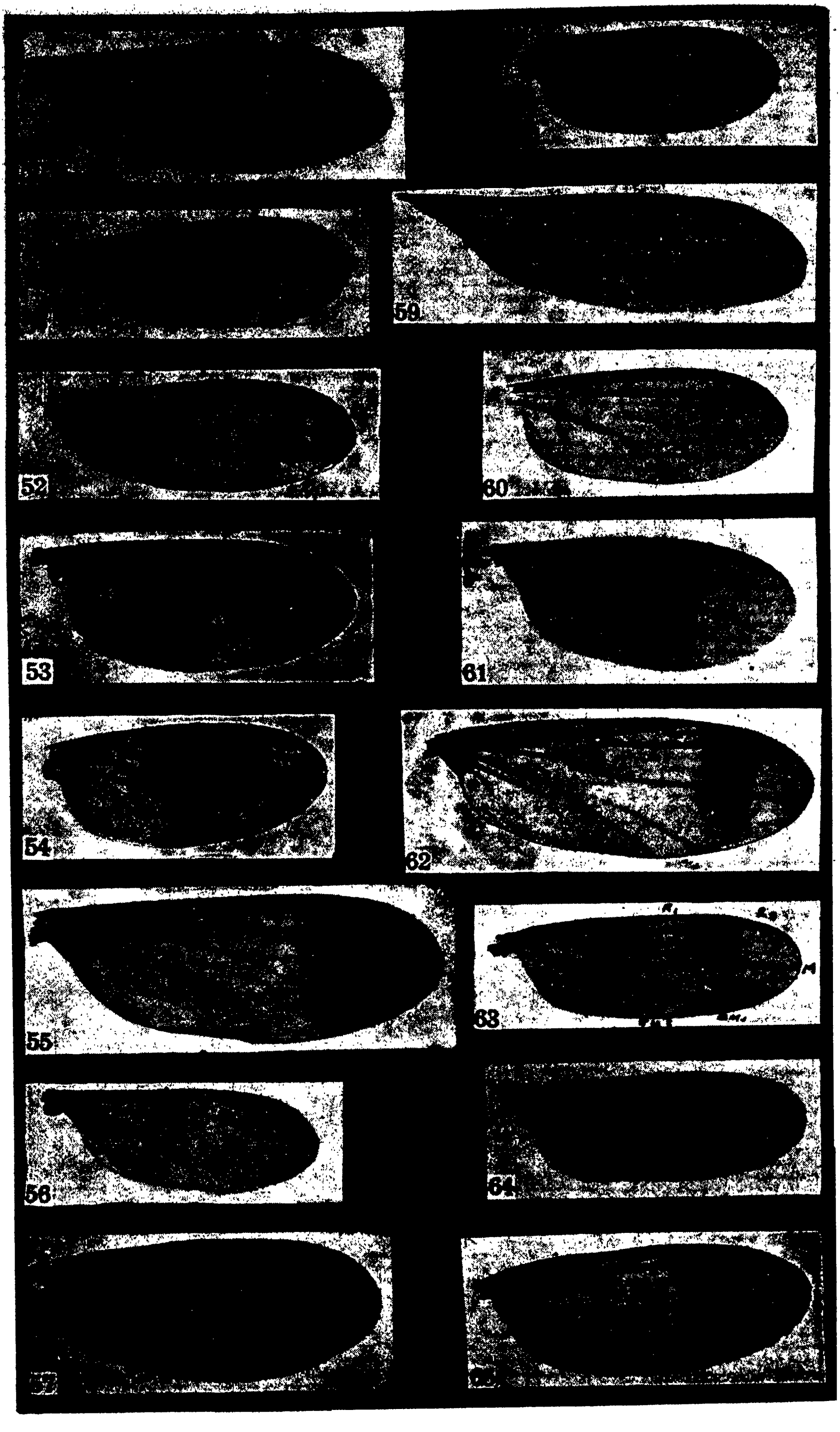
Face p. 876.



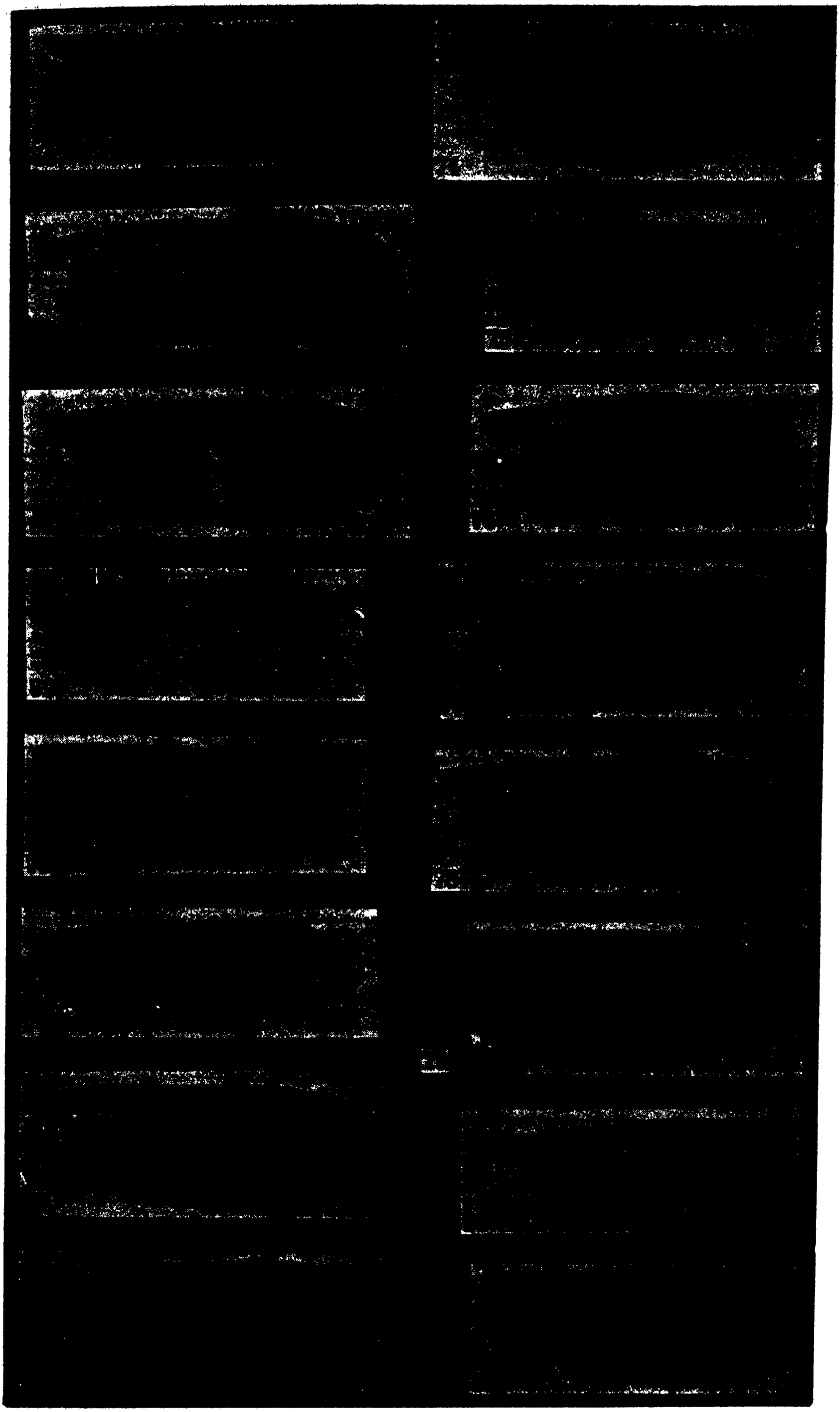
FIGS. 18-33.



FIGS. 34-49.

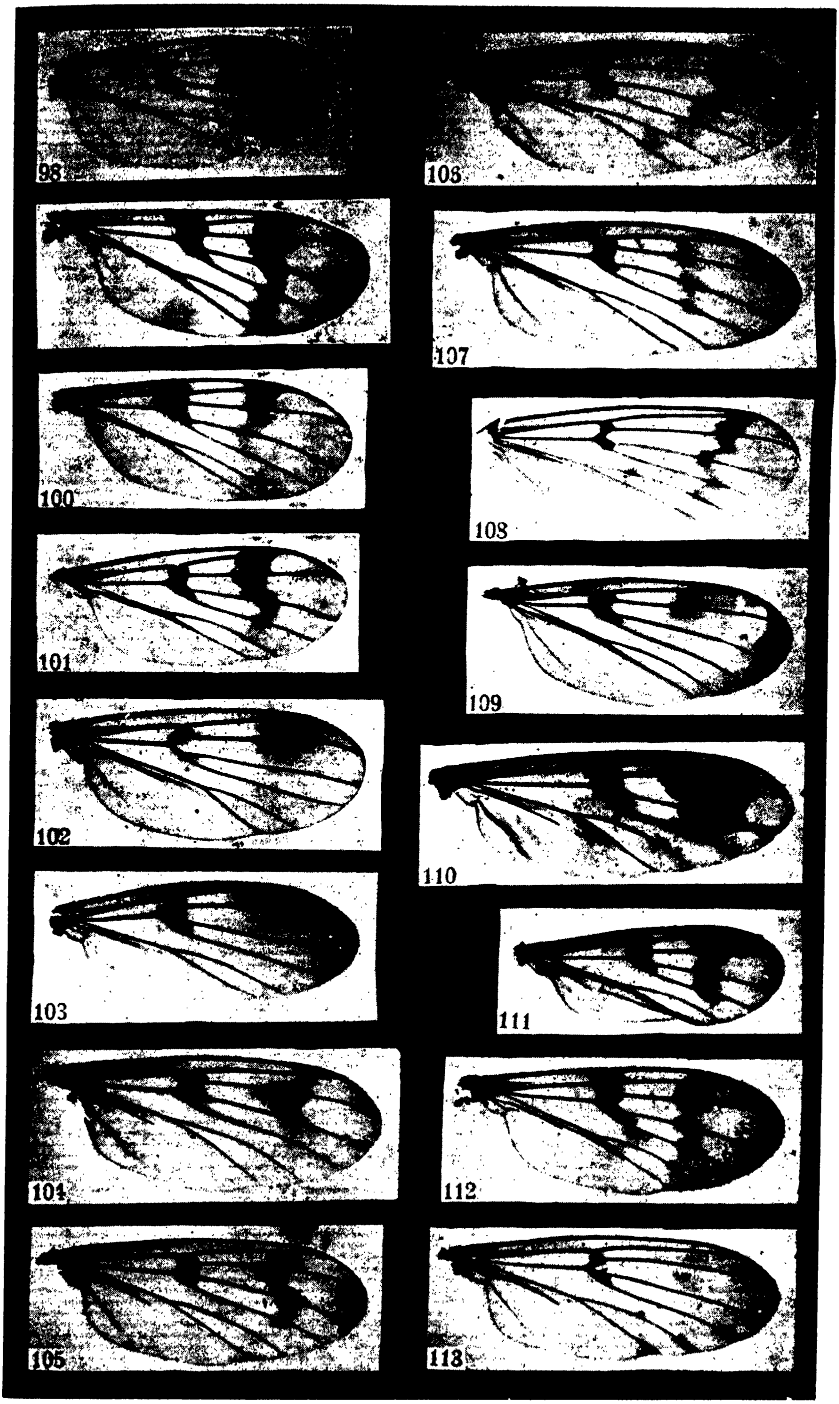


FIGS. 50-65.



FIGS. 66-81..

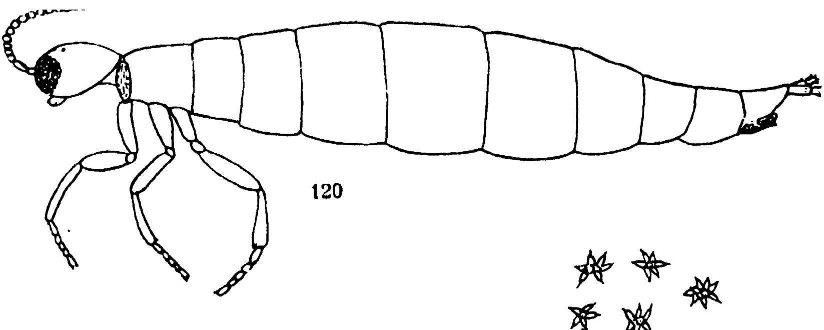
FIGS. 82-97.



FIGS. 98-113.

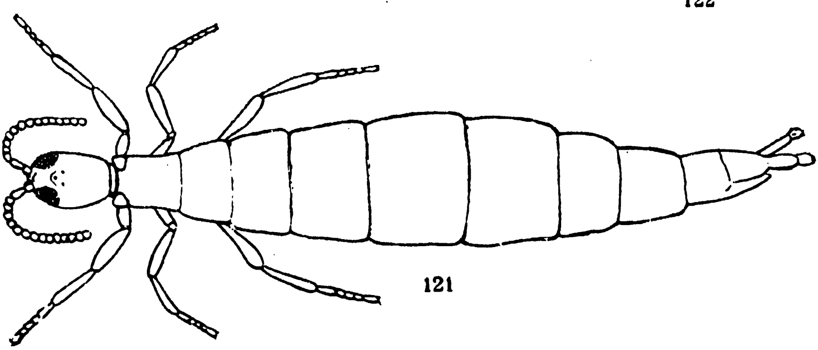
18

119



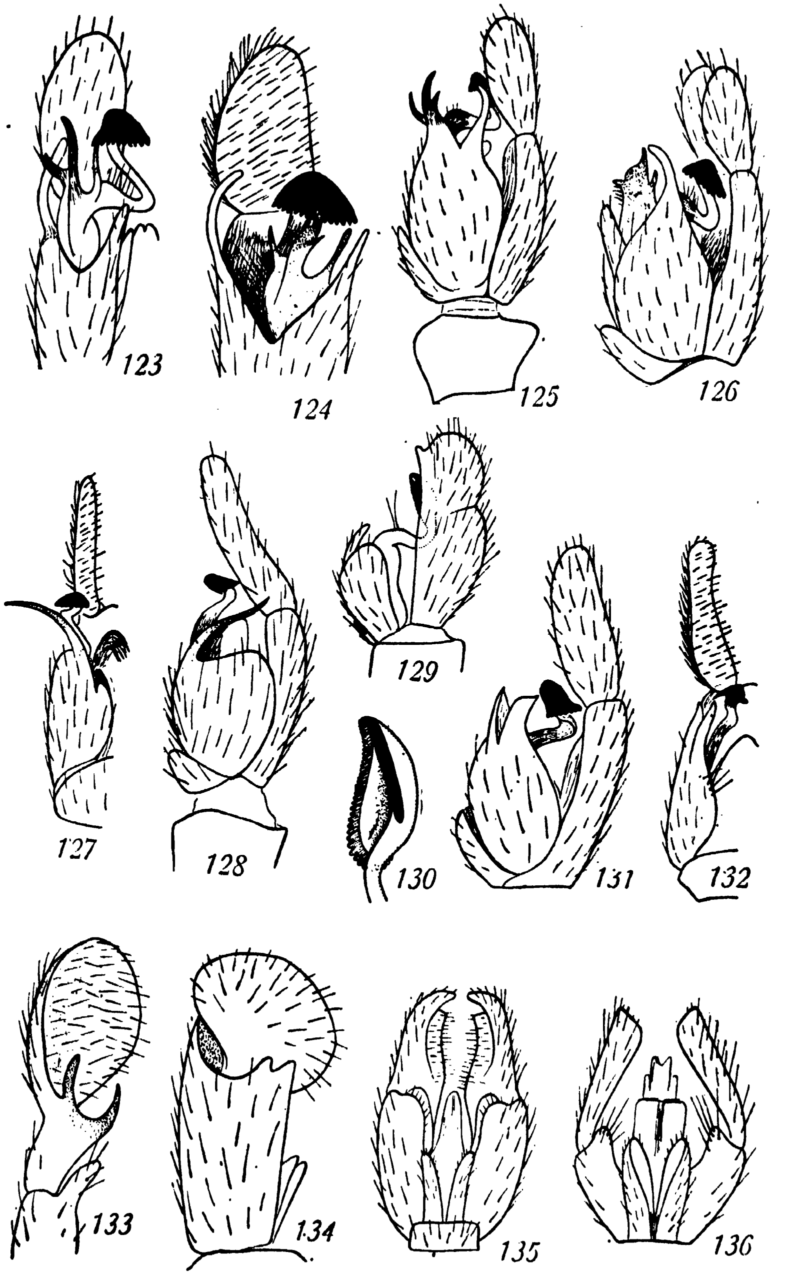
120

122

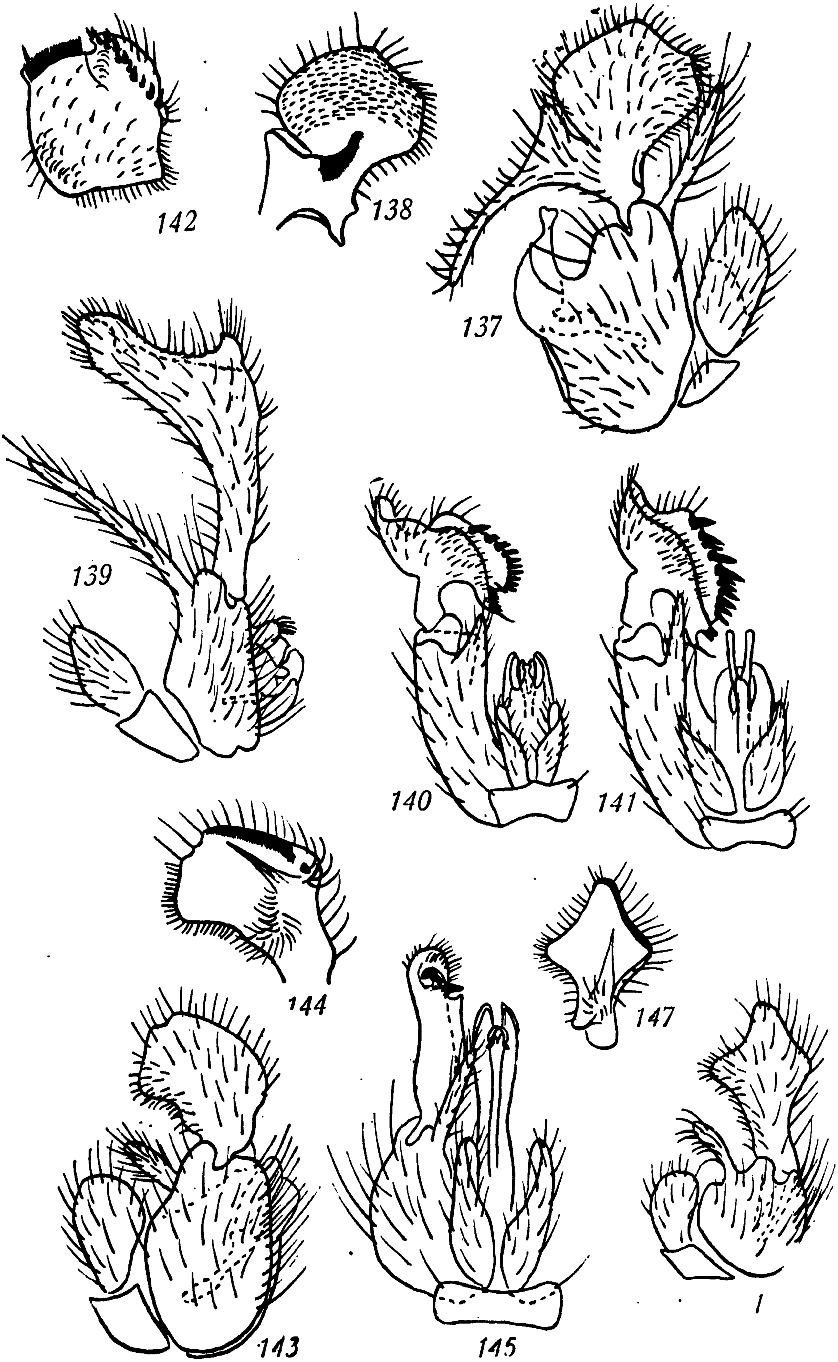


121

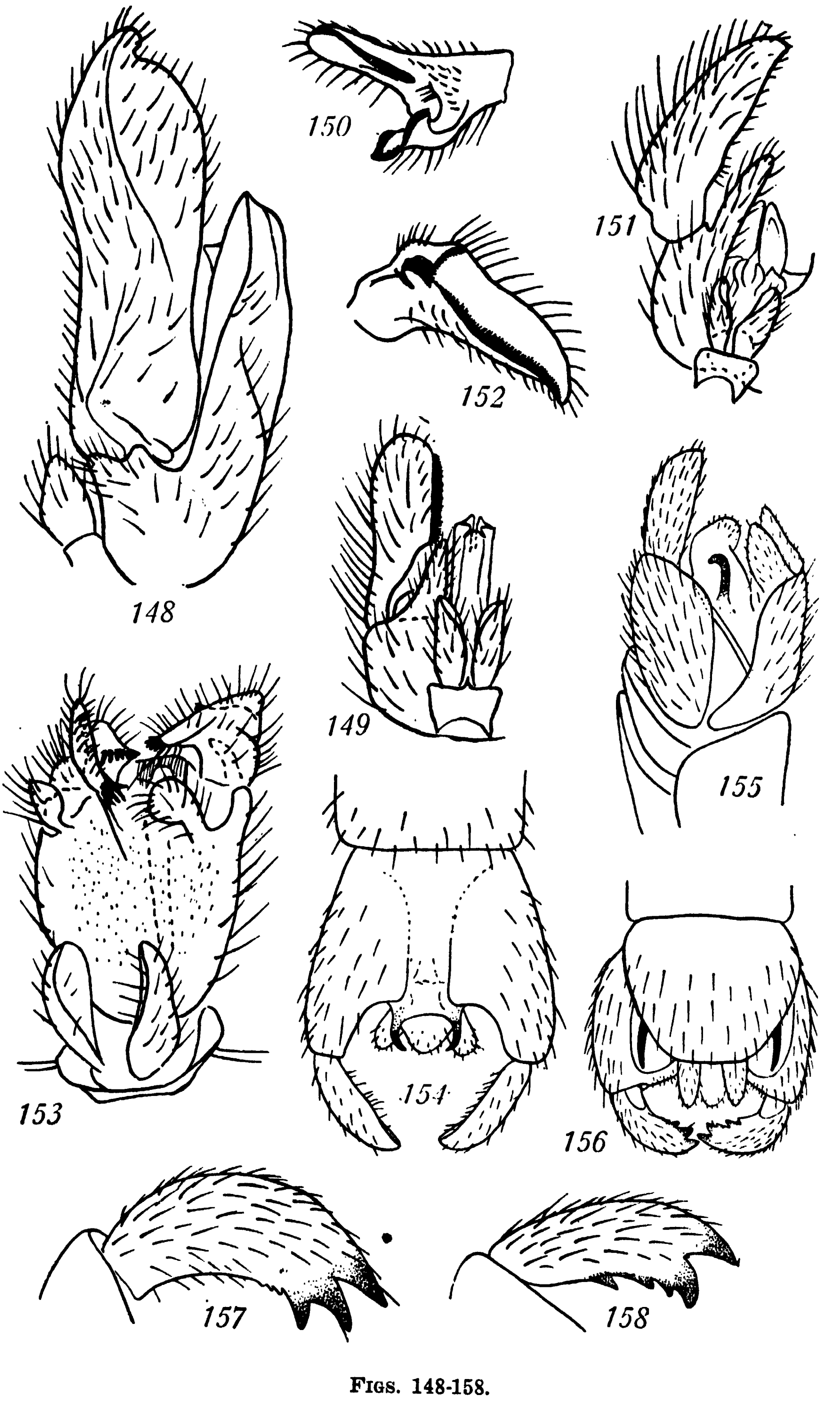
FIGS. 114-122.



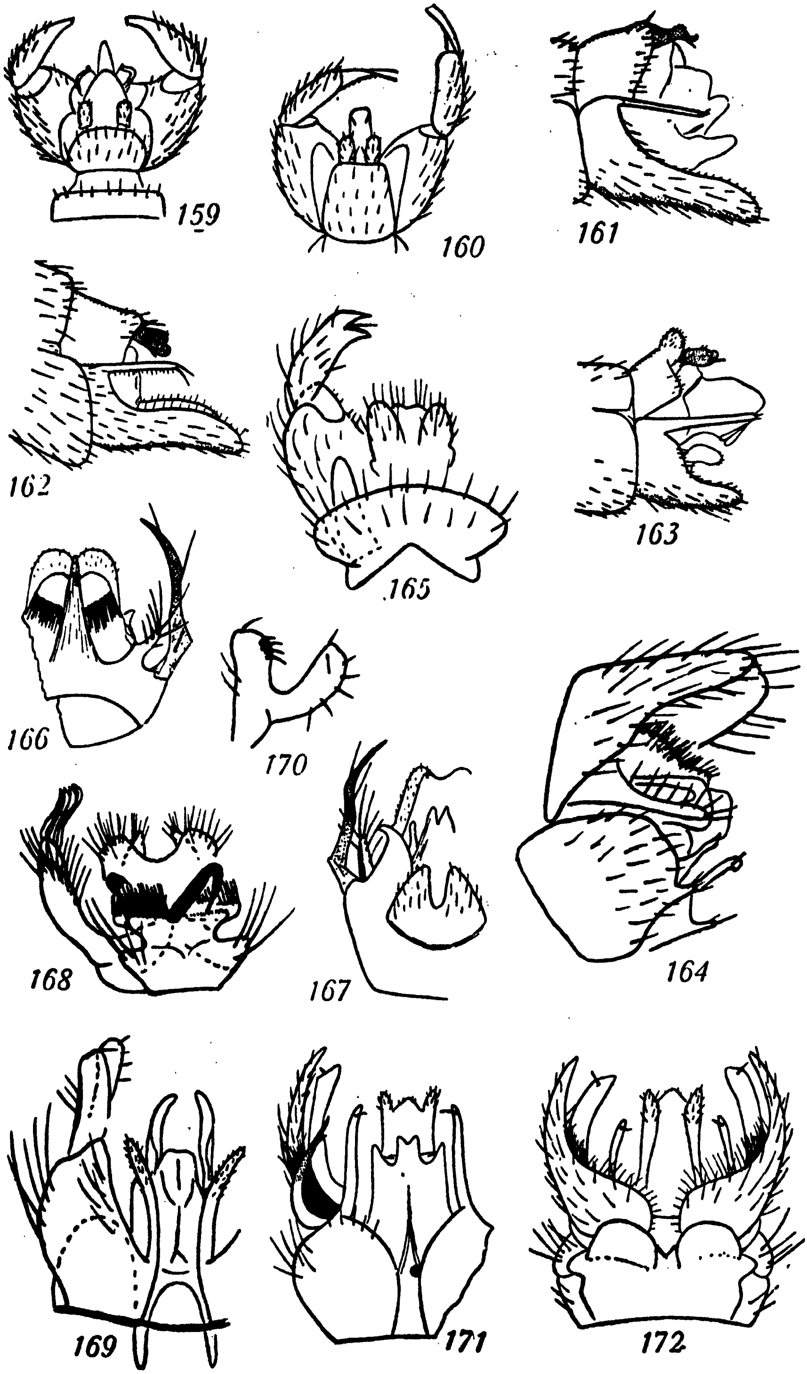
Figs. 123-136.



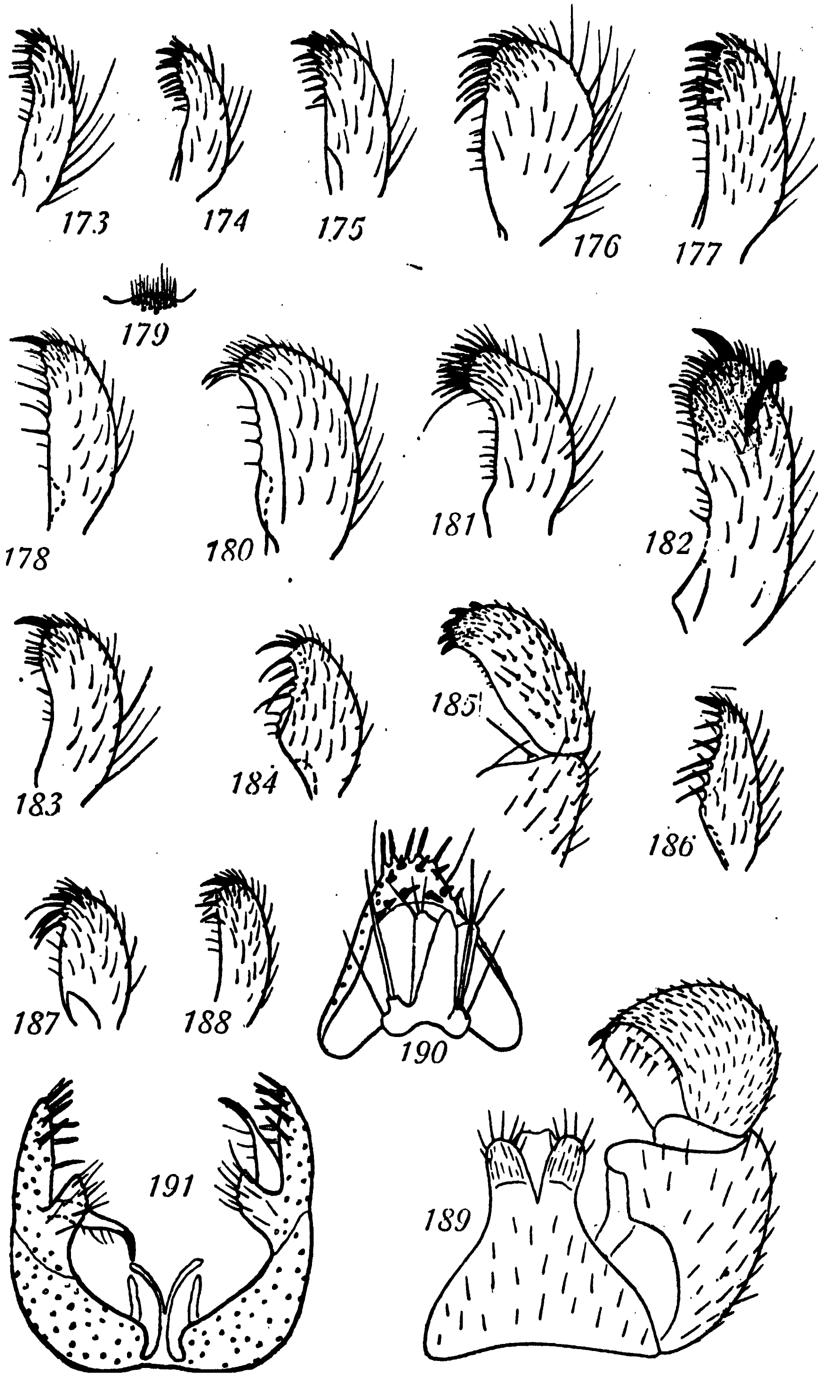
FIGS. 137-147.



FIGS. 148-158.



FIGS. 159-172.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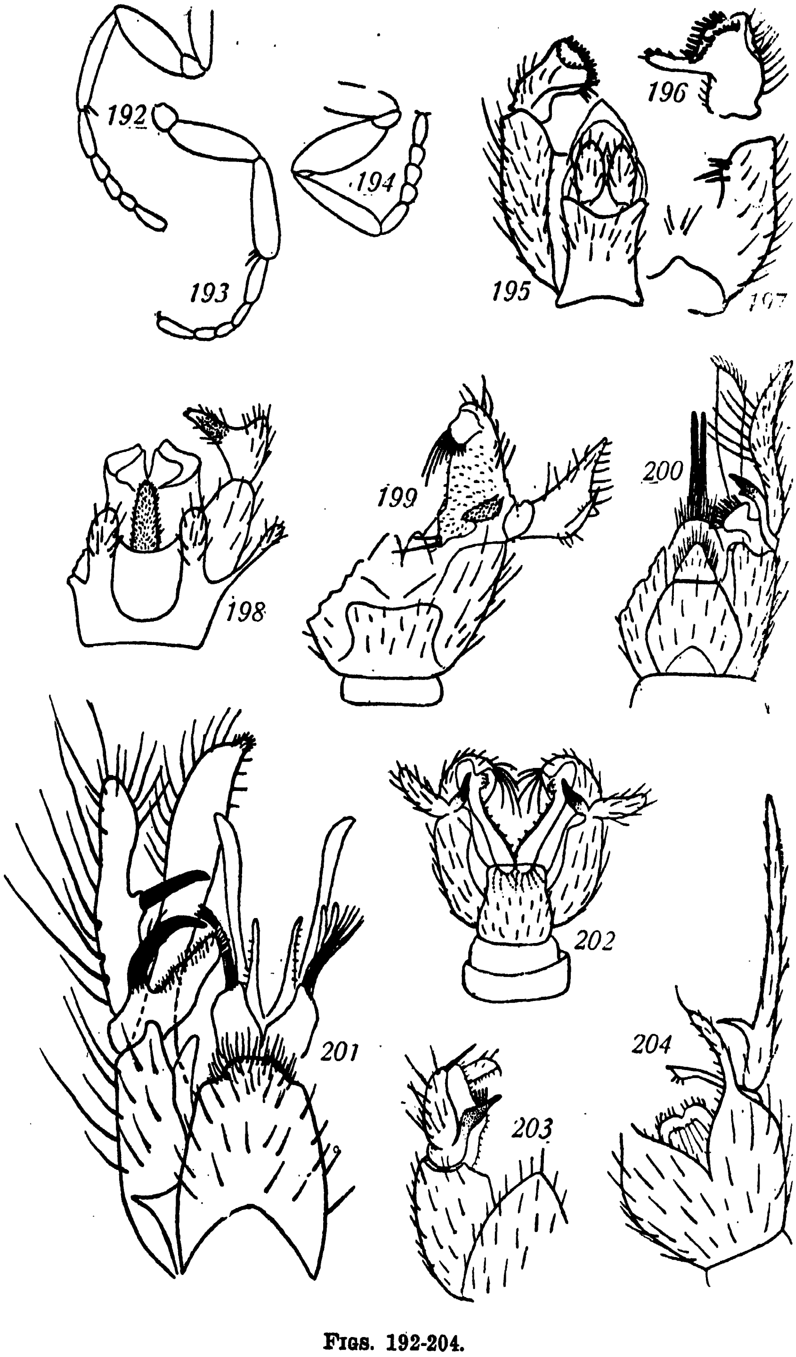
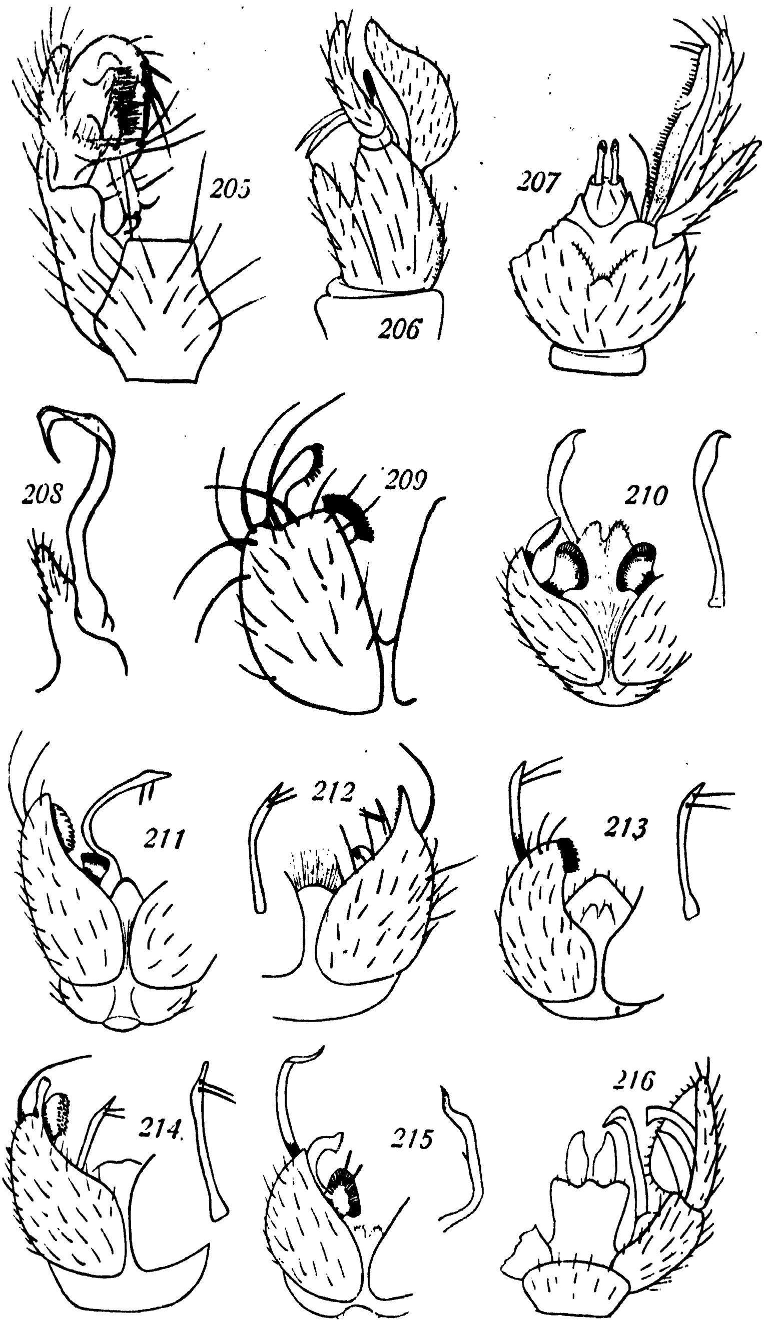
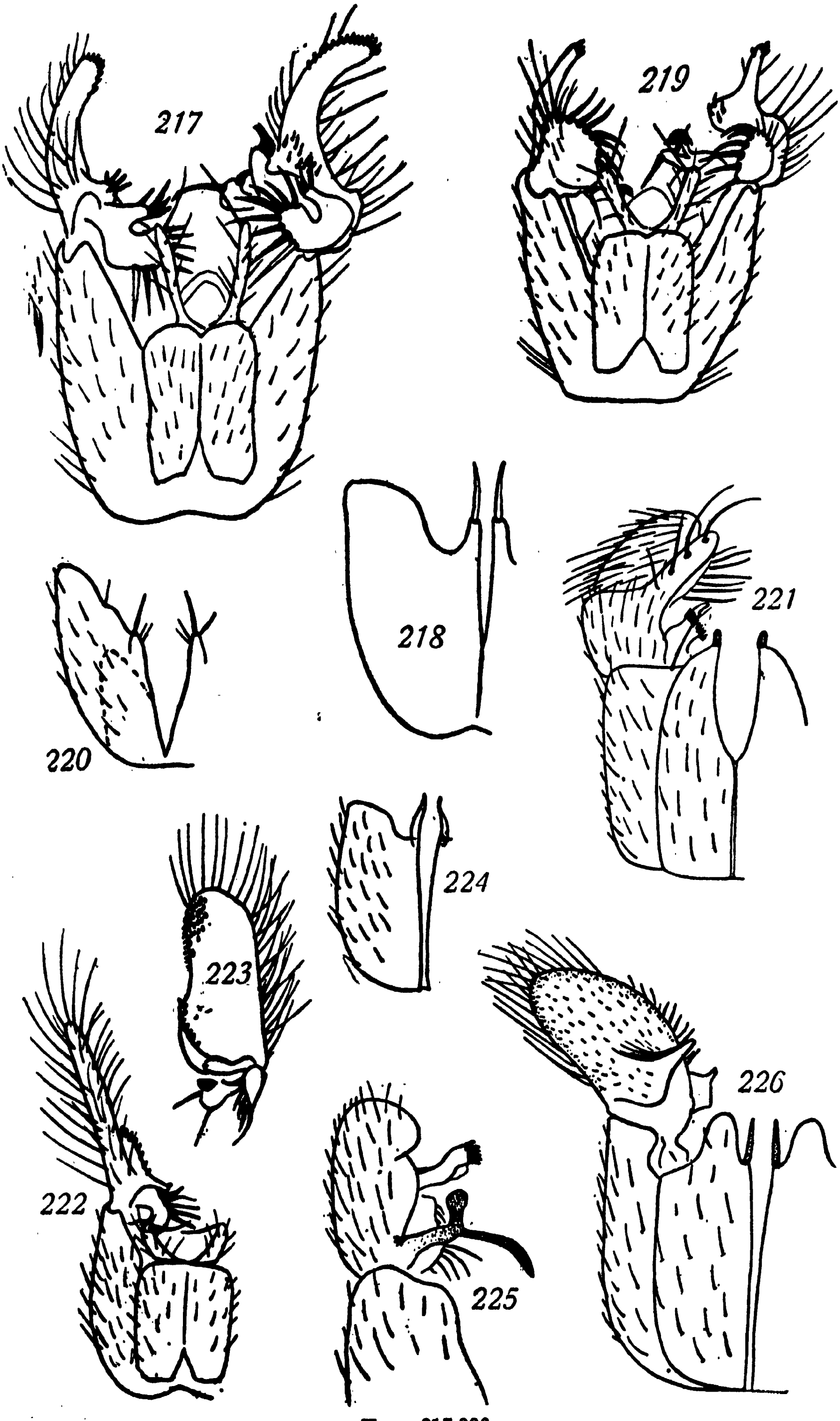
Figs. 173-191.



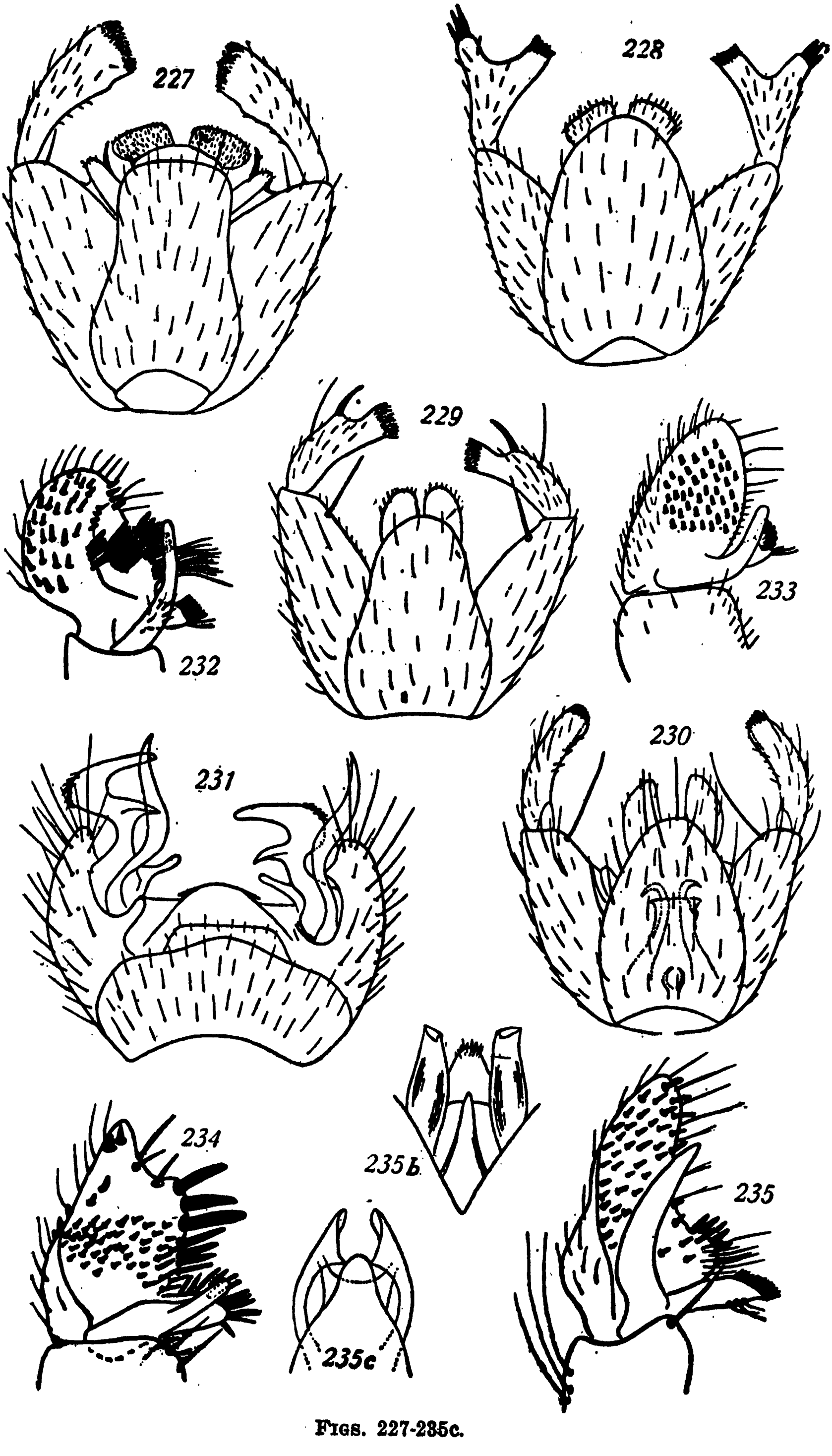
FIGS. 192-204.



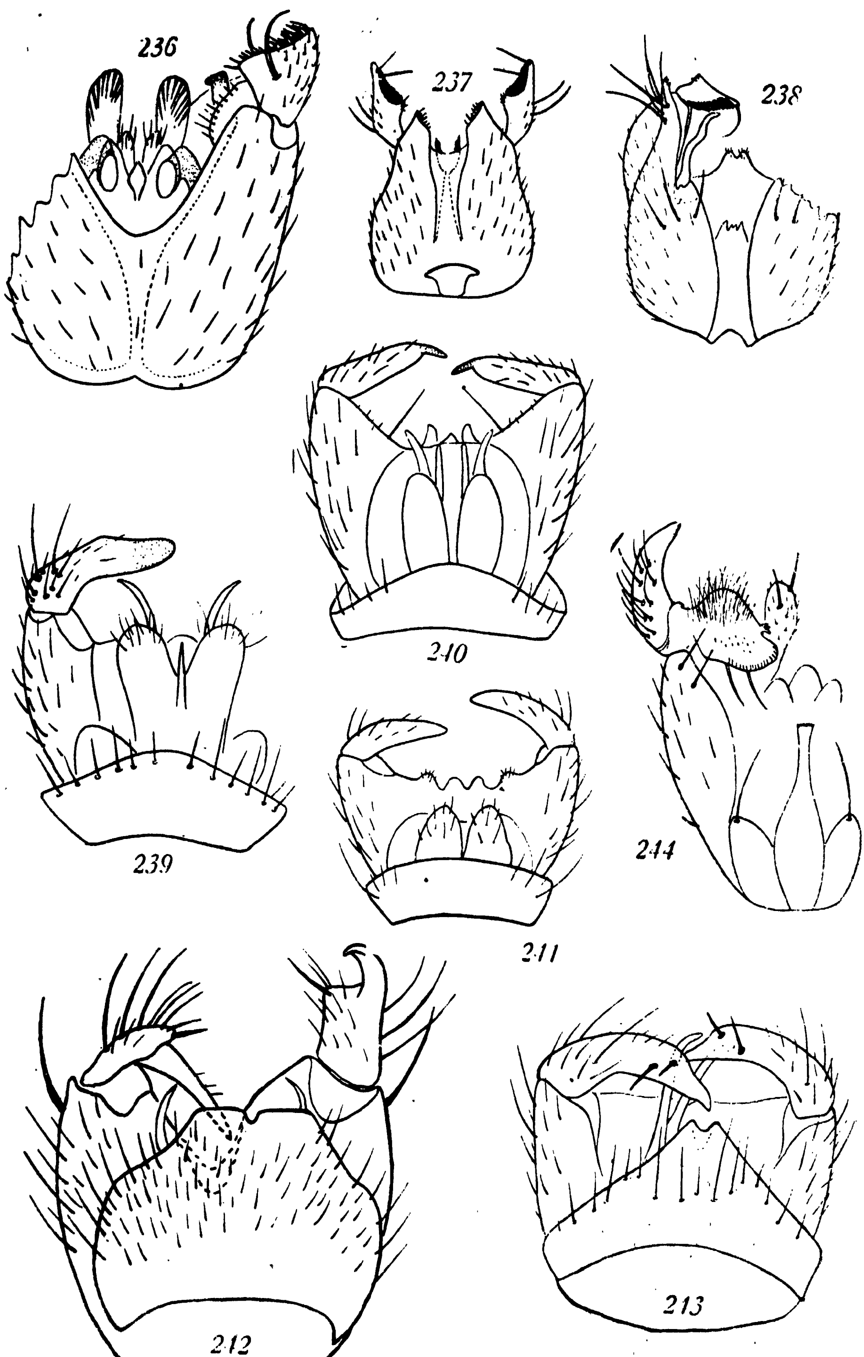
FIGS. 205-216.



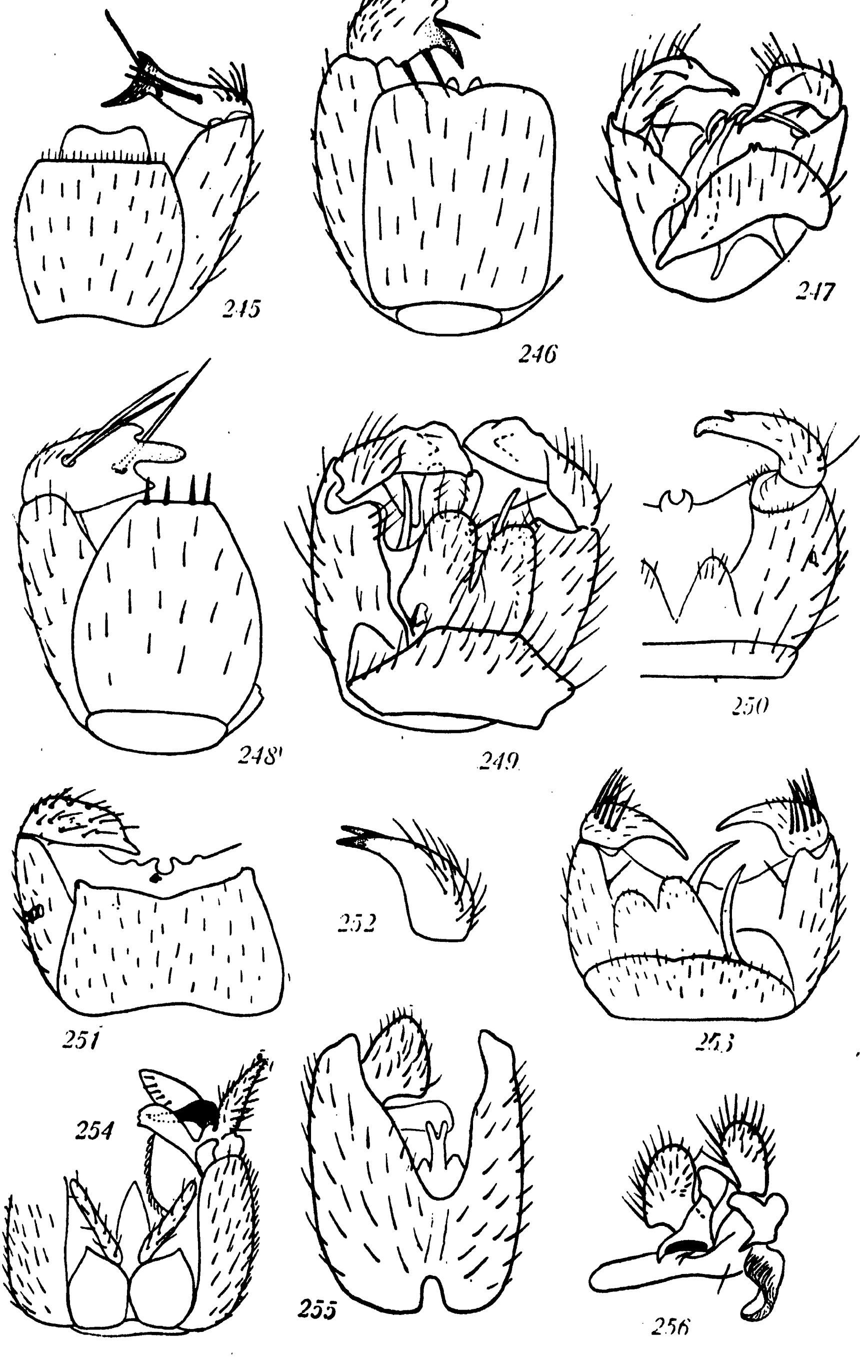
Figs. 217-226.



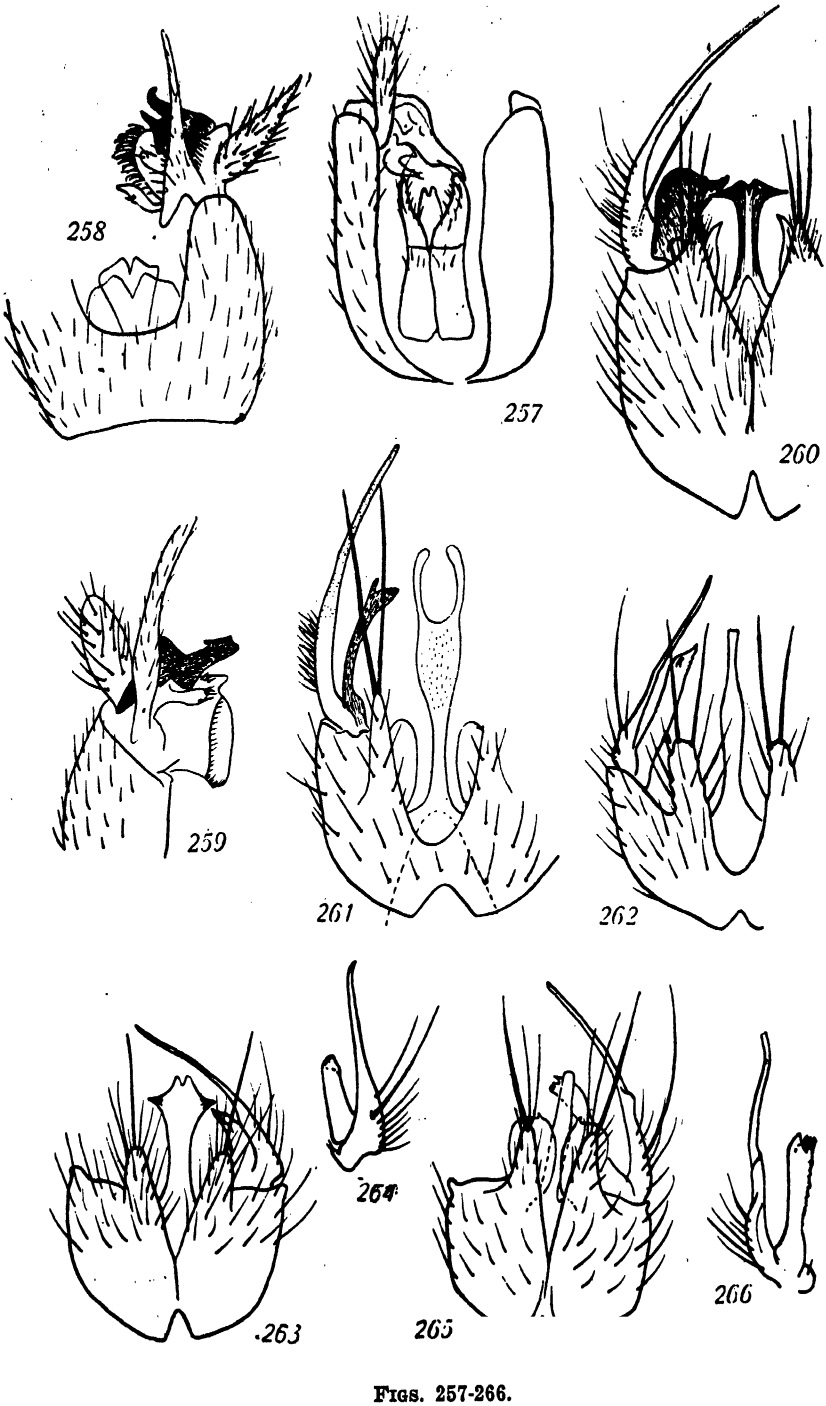
FIGS. 227-235c.



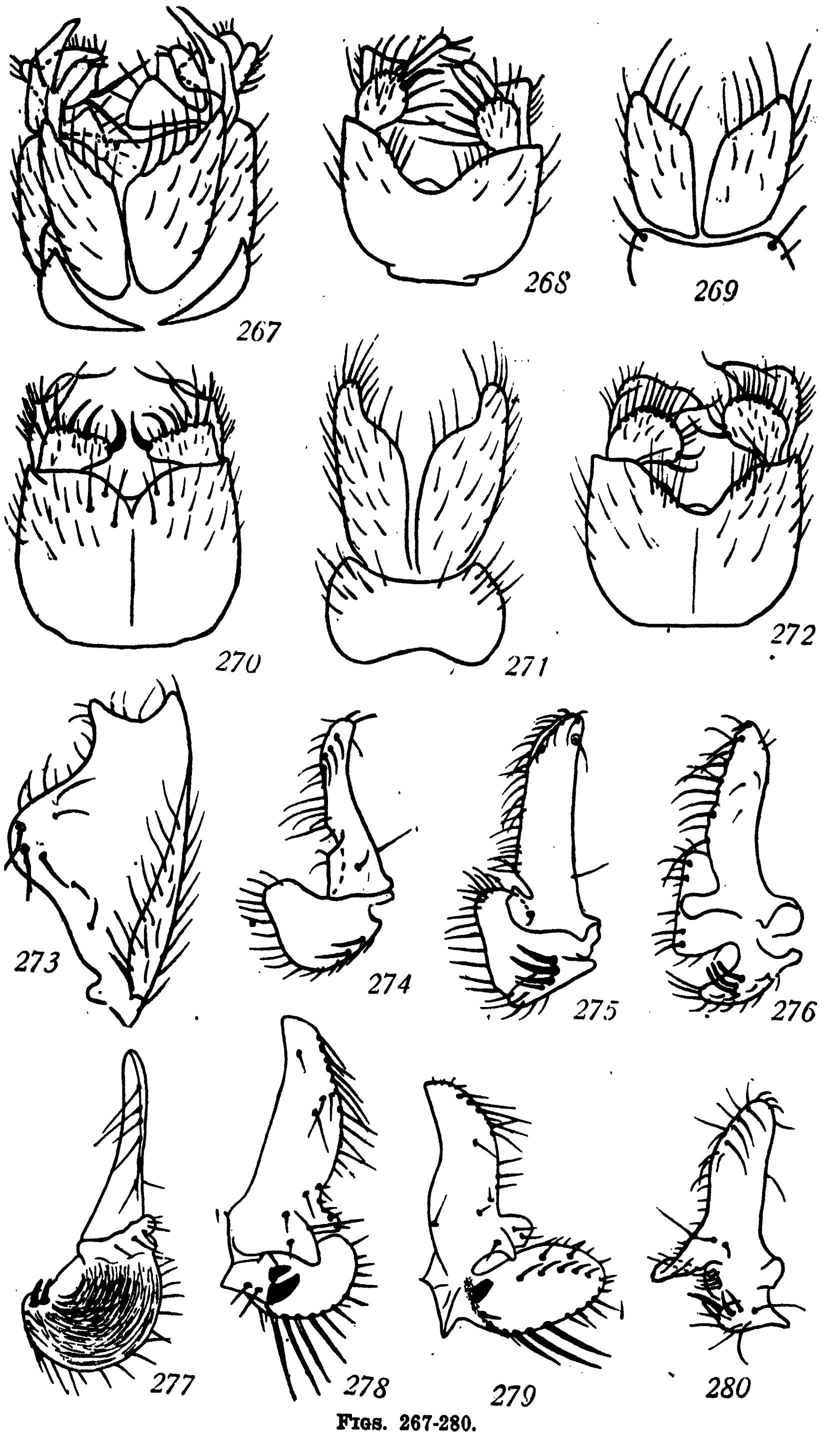
FIGS. 236-244.



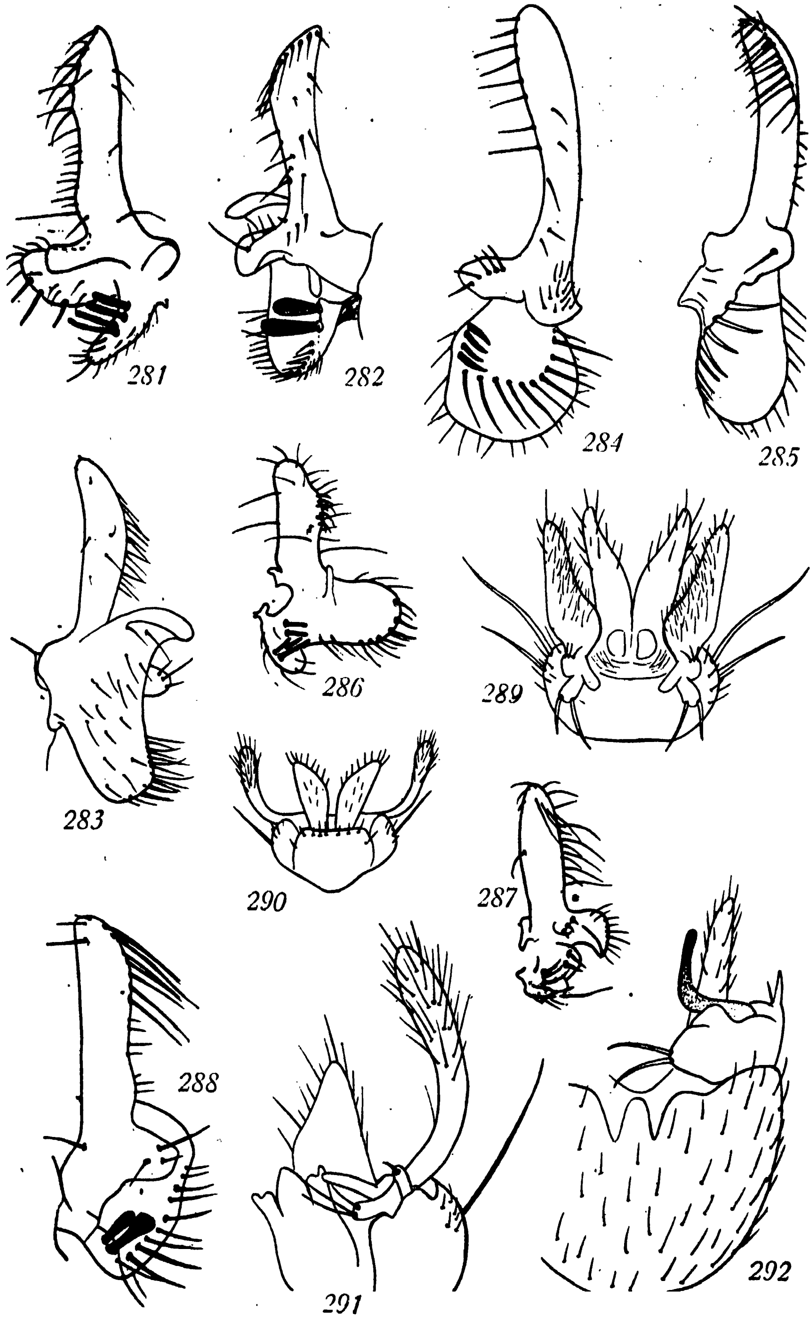
FIGS. 245-256.



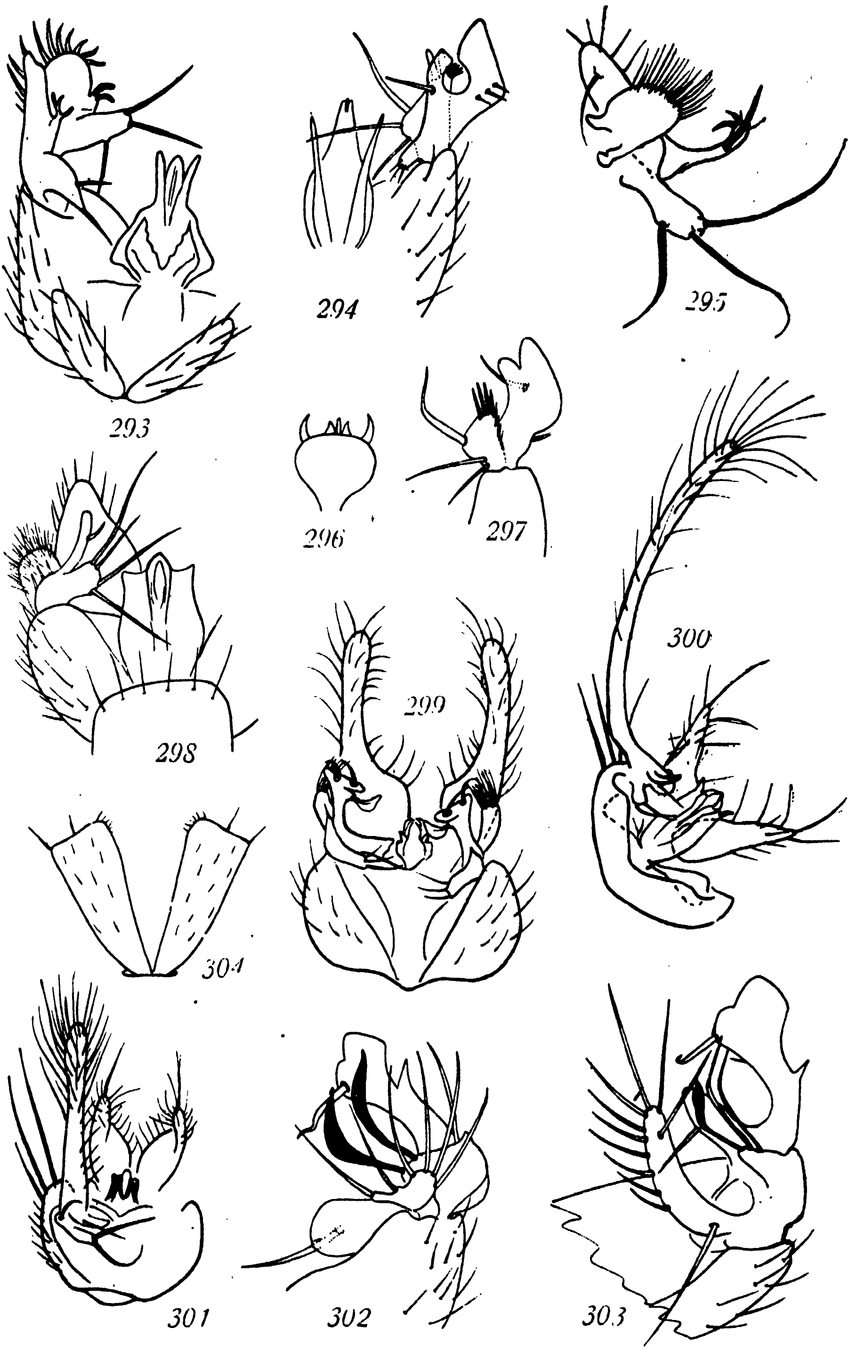
FIGS. 257-266.



Figs. 267-280.



FIGS. 281-292.



Figs. 293-304.

FIG. 221.—*Aphelomera elongata* Tonn., hypopygium from beneath (half).
FIG. 222.—*Aphelomera longicauda* Edw., hypopygium from above.
FIG. 223.—*Aphelomera longicauda* Edw., hypopygium clasper.
FIG. 224.—*Aphelomera longicauda*, hypopygium sternal plate.
FIG. 225.—*Aphelomera opaca* Tonn., clasper.
FIG. 226.—*Aphelomera skusei* Marsh., hypopygium from below (half)

FIG. 227.—*Synapha pulchella* Tonn., hypopygium from above.
FIG. 228.—*Synapha cawthroni* Tonn., hypopygium from above.
FIG. 229.—*Synapha gracilis* Tonn., hypopygium from above.
FIG. 230.—*Synapha similis* Tonn., hypopygium from above.
FIG. 231.—*Heterotricha novae-zealandiae* Tonn., hypopygium from above.
FIG. 232.—*Anomalomyia minor* Marsh., clasper.
FIG. 233.—*Anomalomyia basalis* Tonn., clasper.
FIG. 234.—*Anomalomyia viatoris* Edw., clasper.
FIG. 235.—*Anomalomyia flavicauda* Edw., clasper.
FIG. 235*b*.—*Anomalomyia obscura* Tonn., aedeagus.
FIG. 235*c*.—*Anomalomyia affinis* Tonn., aedeagus.

FIG. 236.—*Cycloneura flava* Marsh., hypopygium from above (half).
FIG. 237.—*Cycloneura triangulata* Tonn., hypopygium from above
FIG. 238.—*Paracycloneura apicalis*, hypopygium from above (half).
FIG. 239.—*Tetragoneura ultima* Tonn., hypopygium from above (half).
FIG. 240.—*Tetragoneura opaca* Tonn., hypopygium from above.
FIG. 241.—*Tetragoneura proxima* Tonn., hypopygium from above.
FIG. 242.—*Tetragoneura spinipes* Edw., hypopygium from above.
FIG. 243.—*Tetragoneura rufipes* Tonn., hypopygium from above.
FIG. 244.—*Trichoterga monticola* Tonn., hypopygium from above (half).

FIG. 245.—*Tetragoneura obscura* Tonn., hypopygium from above (half).
FIG. 246.—*Tetragoneura distincta*, hypopygium from above (half).
FIG. 247.—*Tetragoneura flexa* Edw., hypopygium from above.
FIG. 248.—*Tetragoneura venusta* Tonn., hypopygium from above (half).
FIG. 249.—*Tetragoneura obliqua* Edw., hypopygium from above.
FIG. 250.—*Tetragoneura minima* Tonn., hypopygium from above (half).
FIG. 251.—*Tetragoneura minuta* Tonn., hypopygium from above (half).
FIG. 252.—*Tetragoneura nigra* Marsh., clasper.
FIG. 253.—*Tetragoneura fusca* Tonn., hypopygium from above.
FIG. 254.—*Allodia maculata* Tonn., hypopygium from above.
FIG. 255.—*Allodia quadriseta* Edw., hypopygium from beneath.
FIG. 256.—*Allodia quadriseta* Edw., clasper.

FIG. 257.—*Allodia quadriseta* Edw., hypopygium from above (half).
FIG. 258.—*Allodia fragilis* Marsh., hypopygium from above.
FIG. 259.—*Allodia rufithorax* Tonn., clasper.
FIG. 260.—*Exechia filata* Edw., hypopygium from above (half).
FIG. 261.—*Exechia novae-zealandiae* Tonn., hypopygium from above.
FIG. 262.—*Exechia biseta* Edw., hypopygium from above.
FIG. 263.—*Exechia howesi* Edw., hypopygium from above.
FIG. 264.—*Exechia howesi* Edw., clasper.
FIG. 265.—*Exechia hiemalis* Marsh., hypopygium from above (half).
FIG. 266.—*Exechia hiemalis* Marsh., clasper.

FIG. 267.—*Mycetophila grisescens* Edw., hypopygium from above.
FIG. 268.—*Mycetophila nitens* Tonn., hypopygium from below.
FIG. 269.—*Mycetophila nitens* Tonn., anal lamellae.

FIG. 270.—*Mycetophila nitidula* Edw., hypopygium from below.
FIG. 271.—*Mycetophila nitidula* Edw., anal lamellae.
FIG. 272.—*Mycetophila subnitida* Edw., hypopygium from below.
FIG. 273.—*Mycetophila phyllura* Edw., clasper.
FIG. 274.—*Mycetophila harrisi* Edw., clasper.
FIG. 275.—*Mycetophila intermedia* Edw., clasper.
FIG. 276.—*Mycetophila pollicata* Edw., clasper.
FIG. 277.—*Mycetophila spinigera* Tonn., clasper.
FIG. 278.—*Mycetophila clara* Tonn., clasper.
FIG. 279.—*Mycetophila colorata* Tonn., clasper.
FIG. 280.—*Mycetophila curtisi* Edw., clasper.

FIG. 281.—*Mycetophila crassitarsis* Edw., clasper.
FIG. 282.—*Mycetophila subspinigera* Tonn., clasper inside.
FIG. 283.—*Mycetophila subspinigera* Tonn., clasper outside.
FIG. 284.—*Mycetophila fagi* Marsh., clasper.
FIG. 285.—*Mycetophila vulgaris* Tonn., clasper.
FIG. 286.—*Mycetophila tapleyi* Edw., calsper.
FIG. 287.—*Mycetophila similis* Tonn., clasper.
FIG. 288.—*Mycetophila trispinosa* Tonn., clasper.
FIG. 289.—*Zygomyia nigrita* Tonn., hypopygium from below.
FIG. 290.—*Zygomyia fusca* Tonn., hypopygium from above.
FIG. 291.—*Zygomyia fusca* Tonn., clasper.
FIG. 292.—*Zygomyia nigrohalterata*, hypopygium from below (half).

FIG. 293.—*Zygomyia unispinosa* Tonn., hypopygium from above (half).
FIG. 294.—*Zygomyia flavicoxa* Marsh., hypopygium from above.
FIG. 295.—*Zygomyia eluta* Edw., clasper.
FIG. 296.—*Zygomyia humeralis* Tonn., aedeagus.
FIG. 297.—*Zygomyia humeralis* Tonn., clasper.
FIG. 298.—*Zygomyia distincta* Tonn., hypopygium from below.
FIG. 299.—*Zygomyia diffusa* Edw., hypopygium from below.
FIG. 300.—*Zygomyia filigera* Edw., hypopygium from below (half).
FIG. 301.—*Zygomyia penicillata* Edw., hypopygium from below (half).
FIG. 302.—*Zygomyia nigriventris* Tonn., clasper.
FIG. 303.—*Zygomyia brunnea* Tonn., clasper.
FIG. 304.—*Zygomyia truncata* Tonn., anal lamellae.

The Food Values of New Zealand Fish.

Part 7: The Vitamin Content of the Tarakihi.

(Chilodactylus macropterus.)

By JOHN MALCOLM, M.D.

[*Read before the Otago Institute, 8th December, 1925; received by Editor, 31st December, 1925; issued separately, 8th March, 1927.*]

IN popular language it may be said that in those cases where it has been found to be rich in vitamin-A, fish, as an article of diet, combines the properties of both meat and butter, and since this vitamin is always associated with the fat, the more fatty kinds of fish are likely to be the more valuable in this respect. For this reason the tarakihi (*Chilodactylus macropterus*) was chosen as the subject of these experiments, for previous work in this Department has shown that it may contain from 3% to 10% of fat. The samples used in this work averaged 5% to 7%.

In Paper 6 of this series some preliminary experiments on tarakihi were reported, in which it was shown that the dried flesh and the ether-extracted fat did not give any striking effects—probably due to some loss of the vitamin from oxidation during drying. In this set of experiments it was decided to repeat the use of dried fish, and to compare the result with that of fish preserved by refrigeration.

METHODS.*

Two quantities, each of about a dozen tarakihi, were lightly boiled, and the flesh, separated from the bones, skin, fins, etc., was thoroughly mixed. A certain amount was then weighed out into packets of 100 grm. each, and placed in cold storage till required, while the remainder was dried in the sun and ground to a powder.

The experiments were conducted so as to show what amount of the fish, dried or frozen, was necessary for the growth or maintenance of rats, and, since fish is commonly used as a substitute for meat, eggs, or other protein-rich material, the following plan was adopted for recording the results. The dietetic mixture used for vitamin work on rats usually consists of 20% protein (casein) plus starch, fat, salts, and vitamin B. A similar mixture was made with fish instead of casein. This would correspond to the case of a person living solely on fish as the source of protein, and these experiments are referred to as "20% frozen" or "20% dried" fish diet. In other cases, 15%

*Since the technical details of vitamin experiments are not of great interest to the majority of the readers of the *Transactions*, only a brief account of the method is given and the weight curves have been omitted.

of the protein was supplied by fish and the remainder, 5%, by casein; these are referred to similarly as "15% frozen" or "15% dried," and in still others, 10% fish plus 10% casein, and 5% fish plus 15% casein. The last mentioned would be equivalent to a person obtaining about one-fourth of his daily protein in the form of fish, and would probably correspond to an ordinary breakfast helping.

Results.

"20% frozen" fish diet, made in the way described, produced, in two rats, growth and development that could not be distinguished from normal. When the usual vitamin-A-free diet was substituted for the fish diet, growth ceased, and the animals declined somewhat in weight. When the fish diet was again given, growth was resumed.

On "15% frozen" fish diet, two rats, and on "10% frozen," four rats, grew rapidly, and promptly began to lose weight when the basal diet was substituted. On "5% frozen," four rats grew fairly well up to a certain stage (about 100 grm. weight) then began to decline; "10%" was then given and the weights remained steady, and on "15%" they showed resumption of growth.

The results indicate that tarakihi parboiled, and then frozen, contains a quite appreciable quantity of vitamin-A. Even a breakfast ration of tarakihi would probably yield enough vitamin-A for an adult, apart from other sources of this vitamin in the diet, such as butter, egg, or green vegetables.

"20% dried" and "15% dried" fish diets also showed fairly good growth. "10%" gave only a bare maintenance of weight without growth. While these results with dried fish were distinctly poorer than those with frozen, it was clear that the vitamin had not been altogether destroyed. It is likely that the method of drying in the sun is better than that of drying in a hot-air oven commonly used for analytical work.

The writer is of opinion that tarakihi would be a very suitable fish for canning. It has a distinctive, but not too marked flavour, is rich in fat and vitamin, and, as indicated above, the vitamin is not readily destroyed.

In experiments carried on at the same time, evidence was obtained that the vitamin-A content was little, if at all, affected by tryptic digestion.

The expenses of the investigation were defrayed by a grant from the New Zealand Institute, to which body the writer again desires to express his thanks.

Soil-survey of New Zealand.

By H. T. FERRAR.

New Zealand Geological Survey.

[*Read at the New Zealand Institute Science Congress, Dunedin, 30th January, 1926; received by Editor, 5th March, 1926; issued separately, 8th March, 1927.*]

A SOIL-MAP is designed primarily to show the geographic position and extent of soil-types, howsoever they may be differentiated. The first requirement of a soil-survey of any country is a method of cartographically representing different soil-types. Various methods have been proposed for mapping the soils of New Zealand, but most of these methods have already been proved to be inadequate in other countries where soil-surveys are in progress. The reason for this is that certain factors which differentiate soils are left out of account.

Take some extreme cases as examples:—If soils be differentiated according to texture (1)* a clay, rich in iron, etc., derived from a basic volcanic rock would belong to the same soil-type as a clay, with low content of potassium, phosphorus, iron, etc., derived from a white claystone. If climate (2) is the primary consideration the shingle soils, the loessic down-soils, the limestone upland-soils, and the alluvial flats in the neighbourhood of Timaru would all fall into the same group. If plant assemblages (3) or the revenue-earning capacity of the land (4) be used as a basis, such a survey is hardly a soil-survey.

Grouping of soils according to the quantity of some particular substance they contain, *e.g.* the percentage of iron (5), or iodine (6), or sodium chloride (7), gives only partial results, useful for a particular purpose, but inadequate for most purposes.

It remains to suggest a method which will differentiate soils and which at the same time can be applied in mapping them. A method was outlined by me in 1915 (8), based on geologic-hydrologic considerations and since then other suggestions have been made (9).

In the study of the fauna or flora of a country the origin of that fauna or flora is one of the first points to be considered. In the study of the soils of a country, knowledge of their origin is of fundamental importance. Now all soils are derived from rocks, and may be either resting upon the rocks from which they are derived, or they may have been transported, mixed with other soils, and deposited upon another rock-formation. A geological map portrays these processes. The Geological Survey map of, say, Purua Survey District in North Auckland, or the map of Tiger Hill Survey District in Central Otago, is a ready-made basis for a more detailed soil-survey. Anyone who

*Figures in parenthesis refer to the list of literature appended.

knows either of these areas can see that these maps differentiate certain groups of soils, *e.g.* greywacke hill-country soils, basalt soils, ' gum-land ' soils, in the case of North Auckland, or mica-schist tussock country, quartz-gravel terraces, loessic soils and alluvial flats (meadow-lands) in the case of Central Otago.

Each soil-group may be given a formational name such as is indicated. These names tend to group the soils geographically, texturally, chemically, and agriculturally. The topographical map which forms the basis of the geological map shows the situation and aspect of each soil-group or soil-type, and can be made to include climatic data and other desirable information.

If the practice obtaining in other countries be noted, it becomes manifest that a geological map provides the most useful basis for a soil survey of New Zealand.

REFERENCES.

(1) B. C. Aston: *The N.Z. Journ. of Agric.*, vol. 27, pp. 131-137, 1923.

(2) L. J. Wild: *Trans. N.Z. Inst.*, vol. 49, pp. 476-490, 1917.

(3) L. Cockayne: *Parliamentary Paper*, C-14, pp. 1-44, 1908.

(4) A. H. Cockayne: *The N.Z. Journ. of Agric.*, vol. 31, pp. 80-87, 1925.

(5) B. C. Aston: *N.Z. Journ. Sci. and Tech.*, vol. 7, pp. 216-220, 1925; and *Trans. N.Z. Inst.*, vol. 56, pp. 733-738, 1926.

(6) C. E. Hercus, W. N. Benson, and C. L. Carter: *The Journal of Hygiene*, vol. 24, pp. 321-402, 1925.

(7) H. T. Ferrar (Survey Dept., Egypt): *Special Report on Subsoil Water in Lower Egypt*, pp. 15-16, 1910.

(8) H. T. Ferrar: *Journ. of Canterbury A. & P. Association*, pp. 28-35, 1915.

(9) *H. T. Ferrar*: *Ann. Reports of N.Z. Geological Survey*, 1920 and following, and *N.Z. Geol. Survey Bull.*, No. 27, pp. 8-10, 1925.

Nos. (1) and (4): *The N.Z. Journ. of Agric.*

An Index of Industrial Share-prices in New Zealand.

By J. B. CONDLIFFE,

Professor of Economics, Canterbury College.

[*Read before the Philosophical Institute of Canterbury, 4th November, 1925; received by Editor, 6th November, 1925; issued separately. 8th March, 1927.*]

INVESTIGATIONS made by Mr. A. H. Tocker have shown that the marginal purchasing power available to the people of New Zealand, as indicated by the excess of bank deposits over advances, is governed by the balance of trade as indicated by the statistics of imports and exports. The correlation of these two statistical series over the last twenty years leaves no room for doubt that the credit made available by the banks in the Dominion is regulated practically automatically by the bank balances held in London, which depend upon the balance of visible and invisible imports and exports.

Major movements in the banking figures follow changes in the trade balance with a lag of approximately six months.[1]

Further investigation has shown that, as might be expected, the banking situation, i.e. changes in the marginal purchasing power available to the community, govern the movements of such other important indexes of economic activity as the savings bank returns, the mortgages registered on land,[2] etc. The index of industrial share-prices now presented was prepared independently in order to test the relationship of changes in the volume of available purchasing power to speculative activity.

Similar series representing trade, money, and speculation have been investigated by the Harvard Bureau of Economic Research and have been shown to interweave in a definite relationship.[3] In the Harvard investigation it has been shown that the curve of speculation rises or falls before the index of business activity and business activity before the curve representing monetary conditions. Monetary conditions in turn precede speculative activity and so the cycle is complete.

[1] Economic Journal, December, 1924.
[2] Bulletin No. 5 of Canterbury Chamber of Commerce (May, 1925).
[3] Harvard Bureau of Economic Research—Weekly Letters.

Investigation soon proved, however, that the Harvard method was not readily applicable to New Zealand conditions. The Harvard index of business conditions measures "domestic" trade in the United States—there is available no suitable measure of "domestic" trade in New Zealand. The Harvard index measures monetary conditions by plotting changes in the rate of interest for short-term loans—in New Zealand there is little fluctuation in such interest or overdraft rates and changes in monetary conditions are registered rather in the variations of deposits, due to payments with the banks' London balances being credited to customers in New Zealand. New Zealand has no independent currency and banking system; but works under a Credit-Exchange standard which regulates monetary conditions here according to fluctuations in the London balances of the banks. And, as the present investigation shows, the relationship between these monetary conditions and speculative capacity is quite different also from that obtaining in the United States.

All these differences depend upon the fact that, in the United States, the main movements of business are normally self-contained and arise from domestic causes, while in New Zealand such movements are, in the main, transmitted from overseas.[1] Thus there is in the United States a genuine internal cycle of good and bad trade, but in New Zealand any cyclical fluctuations are merely the reproduction of similar movements in our overseas markets, transmitted to us through the credit-exchange standard which regulates our monetary conditions, and, with them, practically all economic activity in the Dominion.

In order to measure the movement of industrial share-prices, twenty-five companies were selected as representing different sections of the economic life of the community. In each case the ordinary shares of the companies concerned were taken as quoted in the local Stock Exchanges. The prices of these shares at the end of each month are tabulated from the reports of sales made upon the various Stock Exchanges. The price taken in each case is that at which most sales are made, or, in statistical language, "the mode." Each share is then reduced to a percentage of its par value and the indexes thus obtained are combined in a simple unweighted index.

In the selection of items of the index various practical requirements had to be borne in mind. The essential thing was to get a fair variety and, at the same time, an adequate representation of the major industries in the Dominion. A rough weighting was carried out by the number of items of various kinds of shares included in the series. Regard was also had to the possibility of getting frequent quotations reflecting changing economic conditions.

After some experiment, twenty-five shares were selected, as follows:—4 Banks, 2 Insurance, 4 Loan and Agency, 2 Shipping, 2 Meat, 2 Coal, 1 Woollen Mill, 2 Building (Timber and Cement), 1 Sugar Company, 1 Drapery, 1 Drug Company, 1 Paper, 1 Co-operative Association, and 1 Gold-Mining.

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[1] Of Measurement of Business Conditions in New Zealand by A. H. Tocker, "Economic Record" (Journal of the Economic Society of Australia and New Zealand), November, 1925.

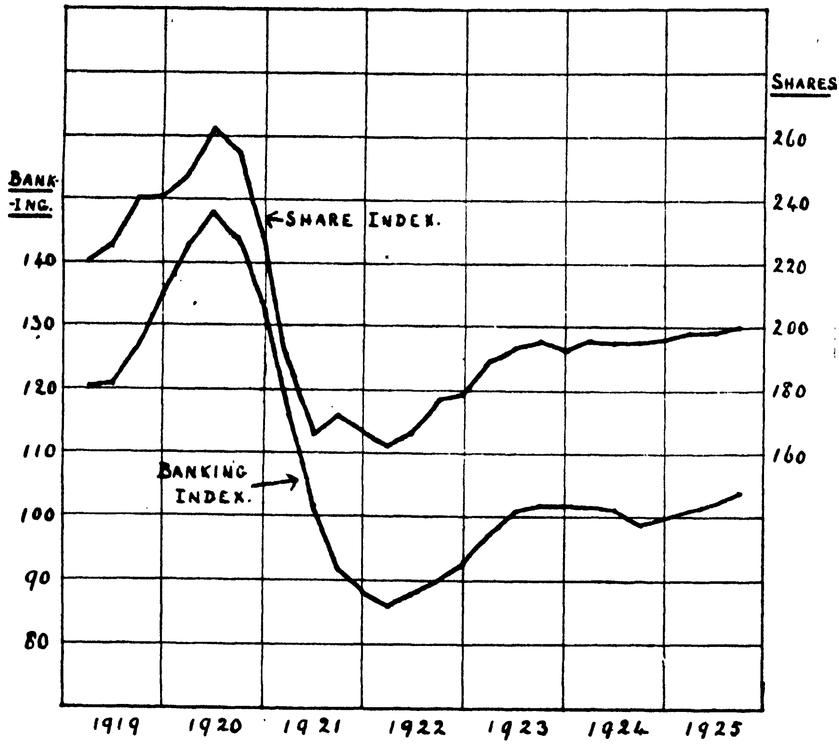
The method of compiling the index may be illustrated by the following table:—

Share	Paid-up Par Value	Price Oct., 1925	Index
National Bank	£2½	£6 3 0	266
Bank of N.S.W.	£20	42 0 0	210
Bank of N.Z.	£1	2 16 9	284
Union Bank	£5	14 15 0	287
N.Z. Insurance	10/-	1 16 3	362
S. British Insurance	10/-	2 10 9	507
Dalgety's	£5	16 0 0	320
Goldsboro Mort.	£1	2 6 0	230
National Mortgage	£2	3 16 0	190
N.Z. Loan & Merc.	£100	92 0 0	92
Huddart Parker	£1	2 5 6	227
Northern S.S. Co.	14/6	16 0	110
Gear Meat Co.	£1	2 0 0	200
N.Z. Refrigerating	10/-	9 1	91
Taupiri Coal	£1	17 0	85
Westport Coal	£1	1 11 0	155
Kaiapoi Woollen	17/-	9 0	53
Wilson's Cement	£1	1 13 9	169
Kauri Timber	15/-	1 13 9	225
Colonial Sugar	£20	51 15 0	259
D.I.C.	10/-	16 0	160
N.Z. Drug Co.	£2	3 4 6	162
N.Z. Farmers'	£2	12 0	30
N.Z. Paper	£1	1 1 3	106
Waihi Gold-Mining	10/-	1 5 3	252

5,032÷25=201.

In gathering information over a fairly long series of years, certain difficulties were met with. Spells of infrequent sales were occasionally met in certain shares, necessitating recourse to interpolation. This was, however, not extensive enough to cause difficulty.

Index of 25 Industrial Share Prices 1919-1925, compared with Index of Banking Conditions (percentage of deposits to advances, etc.)



In the case of every share also there is a normal rise and fall before and after the payment of dividends, either yearly or half-yearly. Since the dividend payments are, however, spread fairly evenly over the months of the year, so that the rise in the value of one share "cum. div." is offset by the fall in the value of other shares "ex div.," any seasonal fluctuations arising from this cause tend to be smoothed out. In order still further to eliminate these regular seasonal variations, the final figures were plotted from a three-monthly average. The number of dividend payments falling within each quarter of the year is, March, 12; June, 13; September, 10; December, 15.

The chief remaining difficulty in measuring movements of share-prices due to changing business conditions arises from the periodic alterations of capital invested in different businesses. In certain instances calls have been made upon shareholders for further capital. This does not involve any great difficulty because the current price of

the share is then reckoned upon the new par value. Similar adjustment is made where share capital is written off as the result of accumulated losses. The opposite case presents a difficulty in calculation which the present index does not attempt to surmount, but which, for the purposes of the index, needs only to be mentioned in order to guard against a possible misinterpretation. Where a company capitalizes its accumulated profits by the distribution of bonus shares, there is a period of a few months during which investors discount the expectation of this distribution by offering higher prices for shares. For a shorter period just before the actual distribution there may emerge two prices for the shares—"ex rights" and "cum. rights"—while the rights to the new issue may be quoted separately. After the distribution of bonus shares has taken place, the share-value drops considerably and settles for some time on a much lower plane, which may even be below par in exceptional cases. The plotted indices of separate shares during the postwar boom period shows a series of increasing values rising to peaks and dropping suddenly.

The index which combines these movements of individual shares is, of course, smoother, since one movement tends to offset the other; but it follows, from what has gone before, that neither the individual level nor the combined index is to be viewed as a measurement of the relative values of shares over busy periods. It is not intended for that purpose; but has been devised purely to measure short-period movements of speculative activity. For this limited purpose its validity is not impaired by the occurrence of distributions of bonus shares, since these cause in themselves speculative activity quite legitimately included in any index devised for the purpose of measuring short-period changes in such activity.

If individual share prices are plotted separately there is, of course, a wide range of variation over a series of years. The many factors which influence different industries are complex and combine in different proportions to affect the value of the shares of individual company in very different ways. It is no part of the economist's task to investigate the conditions of particular businesses and still less to indicate the possibilities of getting rich quickly by speculative investment in particular industries. Any profits to be made in this way will be made after close study of individual businesses in their manifold aspects against a general economic background. It is hardly necessary to say that the proper person from whom to seek advice in the matter of investment is a competent sharebroker, not an economist.

When, however, the vagaries of the movements of individual shares are combined in an index, there are certain interesting economic results which are perhaps best shown by comparison with the results of previous investigations, to supplement which the index was compiled. The following chart shows the index of share prices plotted immediately above the index of bank credit in New Zealand. The remarkable similarity of movement is evident at a glance and the coefficient of correlation between the two series worked out by Pearson's method $r = \frac{\Sigma xy}{n 6_1 6_2}$ is plus .95 with an infinitesimal probable

error of .013. This is proof of the coincident variation of these series, but does not, of course, establish any causal connection between them.

In other countries, and particularly in the United States, it has been shown that movements in the prices of industrial shares follow movements in bank credit and anticipate movements in domestic trade. No doubt if any reliable measure of domestic trade was available in New Zealand, it would be found to follow changes in share prices. Speculators anticipate forthcoming business developments, but the usual relation between bank credit and speculative activity is not present in New Zealand. The curves show rather that share-prices are slightly in advance of and certainly do not lag behind the banking index. This is the case, in the first fall of the slump period, in the middle of 1920, in the recovery of 1921-2, and in the slighter depression of the season 1923-4. Obviously movements in speculation are not governed by local banking conditions as in other countries, though they vary with these conditions. The facts suggest rather that both series are governed by an outside factor.

This lends further support, therefore, to the contention put forward at the beginning of this paper, viz., that changes in New Zealand economic conditions are transmitted from outside. It it natural to find that an appreciation of these changes occurs rather earlier on the Stock Exchange than anywhere else. The banking, instead of preceding first speculation and then general business conditions, moves along with speculation slightly behind it.

The peculiar facts of economic organization in New Zealand, would lead one to expect this. In the United States, the Stock Exchange borrows from the banks. The practice of daily settlement makes possible a much greater development of day to day borrowing at cheap interest rates than obtains even in London, where fortnightly settlement is still the rule and where day to day money is, therefore, absorbed rather by the discount market for bills of exchange. In New Zealand no such market exists at all. There is not even a day to day or week to week fluctuation in interest rates. The bank rate of interest on overdrafts, the only important interest rate in the Dominion from the point of view of short-term credit, has not changed now for nearly three years.[1]

Instead of a free market for short-term credit in which a competitive demand is supplied to any extent at the current price, we have a regulated market in which price is fixed over long periods and the resources of the banks in New Zealand are, in effect, rationed.

In other words, the changes in bank credit are not determined by local conditions but local business conditions are determined by the bank credit available which in turn depends upon the London balances of the banks, which are built up as the net result of our overseas trade and overseas borrowings.

The relationships between different phases of economic activity disclosed by the Harvard investigations do not hold in New Zealand.

[1] Changes in overdraft rates have taken place on the following dates—1st Aug., 1912, 5½%; 15th July, 1920, 6%; 20th Jan., 1921, 6½%; 23rd Feb., 1921, 7%; 3rd Jan., 1923, 6½%.

Instead of a fluctuating movement of local business affecting the bank credit available first for speculative activity and then again for general business, thus completing a fairly short cycle, we have to measure—

(a) The fluctuating relationship of imports and exports, both visible and invisible, the main determining factor in which is the tendency of export prices.
(b) The resultant London balances of the banks which operate in New Zealand.
(c) The transmission of these balances to New Zealand to alter the quantity of deposits in the local banks.
(d) The changed purchasing power thus made available which, in turn, affects imports and so adjusts the trade balance and the London bank balances.

This analysis, which shows the fluctuations of trade activity in New Zealand to be the consequential result of similar (and larger) fluctuations in great industrial countries, transmitted here through our credit-exchange system, is also a further piece of evidence against the crop-cycle theory which has been advanced to account for the trade cycle. In our case at least the trade fluctuations in a country which is predominantly engaged in the production of raw material and food-stuffs influenced by meterological conditions, are induced from industrial countries and through changes in demand affecting the prices of our exports. This supports the results of investigations which are at present being made at Cambridge by a former student of Canterbury College, Mr. H. Belshaw. He has come to the conclusion that the main determining cause of the economic rhythm or cycle which has attracted the attention of economists for many years and has been more widely discussed since the war, is not to be found in harvest variations connected with meteorological cycles; but is due rather to fluctuations in industrial conditions which, owing to roundabout methods of production, take time to work themselves out, and therefore induce an irregular fluctuation of industrial production. Harvest variations may introduce complications and may even, at times, act as extra deciding factors; but our investigations of New Zealand conditions support Mr. Belshaw's contention that the main determining cause of the cycle must be sought elsewhere, and that it is changes in demand caused by industrial fluctuation in our overseas markets and causing changes in our export prices which is the proximate cause of cyclical fluctuations within the Dominion.

Monthly Index of Share Prices, 1919-1925.

Year	Month[1]	Index	Quarterly Average	Index of Bank Credit
1919	February	218		
	March	224	220	120
	April	233		
	May	224		
	June	231	229	121
	July	240		

[1] No Stock Exchange quotations in January.

Year	Month[1]	Index	Quarterly Average	Index of Bank Credit
1919	August	236		
	September	243	240	127
	October	241		
	November	241		
	December	243	241	135
1920	February	248		
	March	251	248	143
	April	260		
	May	263		
	June	264	262	148
	July	266		
	August	265		
	September	233	255	144
	October	237		
	November	226		
	December	214	226	133
1921	February	189		
	March	175	188	116
	April	169		
	May	163		
	June	166	166	102
	July	171		
	August	172		
	September	172	172	92
	October	170		
	November	167		
	December	165	167	88
1922	February	163		
	March	162	163	86
	April	162		
	May	167		
	June	170	166	88
	July	173		
	August	178		
	September	179	177	90
	October	177		
	November	179		
	December	182	179	93
1923	February	190		
	March	191	189	97
	April	190		
	May	193		
	June	197	193	101

[1] No Stock Exchange quotations in January.

Year	Month[1]	Index	Quarterly Average	Index of Bank Credit
1923	July	197		
	August	194		
	September	193	195	102
	October	194		
	November	195		
	December	191	193	102
1924	February	195		
	March	196	195	102
	April	197		
	May	194		
	June	194	195	101
	July	193		
	August	195		
	September	196	195	99
	October	197		
	November	196		
	December	196	196	100
1925	February	199		
	March	198	198	101
	April	197		
	May	199		
	June	199	198	102
	July	199		
	August	201		
	September	201	200	104

[1] No Stock Exchange quotations in January.

The Radio Activity of the Karapiti Blowhole.

By M. N. Rogers, M.Sc.

(Communicated by Dr. C. C. Farr, F.N.Z. Inst.)

[*Read before the Philosophical Institute of Canterbury, 2nd December, 1925; received by Editor, 8th December, 1925; issued separately, 8th March, 1927.*]

The following examination of the Radon-content of the gases from the Karapiti Blowhole was made to confirm a result which the writer and Mr. F. J. T. Grigg, M.Sc., obtained in 1921.

The Blowhole is situated about three miles north of Taupo, and emits a large quantity of steam (mixed with other gases) at a considerable velocity. Two small cans of the gas were collected over water and kindly forwarded by Dr. C. C. Farr from Taupo, and were examined immediately on arrival in the Physics Laboratory, three days after collection.

The gases were removed from the cans into an evacuated electroscope which was connected by rubber tubing to a brass tube soldered to the top of the can. Water was allowed to enter through a small hole in the bottom of the can, the increase in weight of the can thus giving the volume of gas placed in the electroscope. The gases were carefully dried by bubbling slowly through concentrated sulphuric acid.

The electroscope consisted of a brass box containing a sulphur insulated gold leaf. The leak obtained with the gas was more than one thousand times the natural leak, which could, therefore, be neglected, but continued observations of the natural leak were made throughout the examination. The constant of the electroscope was one scale division per minute for 45×10^{-12} grms. of Radium.

Five separate quantities of the gases were placed in the electroscope, and the maximum variation was not more than 15% from the mean.

The Radon-content of the gases per cubic centimetre was found to be that quantity which would be in equilibrium with 8.4×10^{-12} grams of Radium. This is in fair agreement with the value (as yet unpublished) of 6.0×10^{-12} obtained on the previous occasion. The difference in the values is most likely due to the different method of standardization as, in the former case, the emanation was liberated from pitchblende of known composition by fusion at 1,000 degrees C., while, in the latter, a solution of the emanation was employed.

The rate of fall of the leaf was found to rise over a period of four hours from 3.8 to 5.2 divisions per minute, confirming the conclusion that the ionization was due to Radium-emanation.

An Examination of the Radon and Iodine-Content of certain Christchurch Artesian and other Waters, with respect to the Incidence of Goitre.

By M. N. ROGERS, M.Sc.

(Communicated by DR. C. C. FARR, F.N.Z. Inst.)

[*Read before the Philosophical Institute of Canterbury, 5th August, 1925; received by Editor, 8th December, 1925; issued separately, 8th March, 1927.*]

THE present research arose from the observation that Christchurch which has a particularly pure artesian water supply with a radium emanation content far above the ordinary (Farr and Florance, 1909), has also a high incidence of goitre. The emanation-content of the water is ten or twenty times that of any other New Zealand samples so far tested. It was therefore thought worth while to investigate the possibility of a connection between the radioactivity and the goitre incidence. Later an examination for iodine in the drinking waters was also made, for this element is known to be of fundamental importance for the functioning of the thyroid gland.

Canterbury affords excellent opportunities for investigating the connection between water-supply and the prevalence of goitre; for the water is obtained from artesian wells and the goitre varies markedly within so small an area that other conditions may be considered as approximately the same. The drinking waters which serve certain selected localities were examined both for emanation and for iodine, and the results tabulated against the endemicity.

THE EXAMINATION FOR RADIOACTIVITY.

The samples of water for examination of radioactivity were collected by suction into evacuated flasks so that no emanation was lost by splashing. About one-half litre of water was employed for the examination, and the emanation from this quantity generally increased the "natural leak" of the electroscope by about 40 times.

The electroscope employed was a brass box, and the leaf system was a short sulphur column supporting a thin brass strip and gold-leaf. The leaf potential was about 200 volts and the "natural leak" constant at 4.4 divisions per hour, and this leak could usually be neglected.

The electroscope was first evacuated and then connected with the flask. Each solution was boiled for half-an-hour, air being bubbled through at intervals to sweep over the gas into the electroscope. The gas was carefully dried by concentrated sulphuric acid.

The following are the results of the examination tabulated against the goitre incidence:—

Locality	*Radioactivity*	*Goitre*
Waltham	229	59
West Christchurch School	150	75
Boys' High School	210	75
Girls' High School	160	75
Sydenham	280	70
Heathcote	38	14
Woolston	84	52
Timaru	0	70

It will be noticed that the relations between the two columns do not suggest any definite conclusions about the theory of radioactive causation. The fact that no radium emanation is present in the Timaru drinking water weakens the theory, and shows at any rate that if radium emanation is a cause of the disease it cannot be proved by simple examinations of the drinking water. In order to test the point further, four gallons of water from Timaru were boiled to one litre and stored for a month. The growth of radium emanation was very small, and showed that the dissolved radium itself must be a very minute quantity. For the waters other than Timaru a fair correlation can be established.

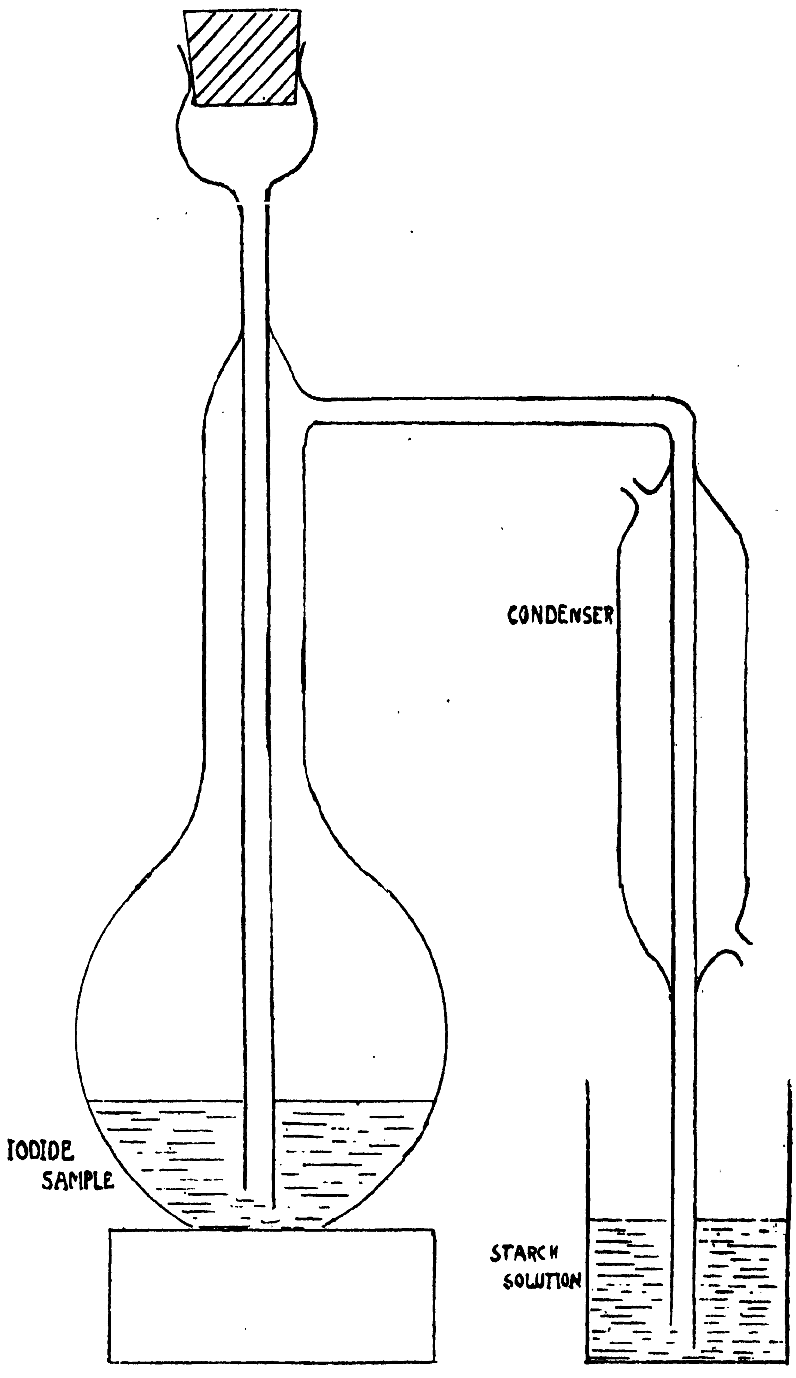
Obviously a more direct way of examining the influence of the emanation would be to administer known quantities of it directly, and after a convenient period observe the resulting effects. Work along these lines is now being undertaken by Drs. Milligan and Pearson at the Christchurch Hospital.

Examination for Iodine.

The value of experimental results in showing any relation between the presence (or absence) of iodine and the prevalence of goitre is limited, because our knowledge both of the sources of iodine and in the exact tabulation of goitre incidence is so uncertain. Iodine, though absent from the soil, may be present in drinking water or foods, and until we are more or less satisfied about all such possible sources of supply, our conclusions will be less valuable than we could wish.

In a small country like New Zealand we may assume that the kinds of food consumed do not vary greatly, so that foreign sources of iodine can hardly be responsible for the marked variation in goitre in different districts. Therefore, should it often occur that in places where the soil and drinking-water possess a low iodine content there is at the same time a low goitre incidence, it would be necessary for those who hold the iodine theory to indicate either (a) Other sources of supply, or (b) Alleviating circumstances. At the same time, should the iodine-content of either soils or waters be high the incidence should be low.

The second reason why relations experimentally established must be uncertain, is that our tables of goitre incidence are drawn up from observations on children of different ages and sexes whose environments may be very different and who may possess the disease in at least four different degrees of development, viz., incipient, small, medium and large.


CONDENSER
IODIDE
SAMPLE
STARCH
SOLUTION

The present contribution confines itself to an analysis of the Christchurch Artesian waters.

Method of Estimation of Iodine

The method of estimation of iodides consisted essentially of the distillation of the iodine into a starch-iodide solution after removal of nitrates and of other salts. The quantities were estimated by colorimetric comparison with standards of known strength. Several other methods were looked into, but the method adopted appeared after investigation to be the most satisfactory and yielded consistent and satisfactory results.

Preparation of Starch Iodide.—The starch was prepared by dissolving about one gram of "soluble" starch as a paste in 50 cc. of hot water and allowing it to cool. To three cc. of this were added three drops of a solution containing ½ grm. per c.c. of pure potassium iodide solution. Into this was distilled the iodine from the solution under examination.

A diagram of the distilling apparatus is shown below. It was all glass, consisting of a thistle-funnel sealed into the neck of a small distilling flask. The steam was condensed as shown, and the iodine liberated was absorbed in the starch-iodide-solution. In the following description it is to be understood that the iodine estimated is of the order 10^{-5} grms.

Oxidizing Agents.—Several oxidizing agents for the liberation of the iodine were tried, *ferric chloride* eventually proving most satisfactory. Chromates and permanganates liberated bromine too readily, while potassium ferri-cynade decomposed on heating, and any blue colour present in the starch-iodide solution was, in this case, immediately destroyed. In fact an excess of iodine added to this starch solution, which contained HCN dissolved, failed to give any blue coloration.

The ferrichlorid contained a minimum of 0.005 grms. cc. In distilling, the flask contained not more than 20 cc. of solution, so that two or three minutes' boiling served to obtain the whole of the iodine. With much higher dilution the iodine was liberated very slowly.

Influence of other salts.—It was found necessary in dealing with such small quantities of iodine to remove any excess of other salts present in the sample. In the case of sodium chloride for instance, 2.0 grms. in 20 cc. allowed only a trace of the iodine to be liberated. With 1.4 grms. about one-half the iodine was liberated, while 0.7 grms. did not prevent the liberation of the iodine.

In the case of other compounds, e.g., caustic potash, ammonium chloride, the same inhibiting action was observed when these are present in excess.

A distillation was also made with potassium bromide. It was observed that a trace of bromine was liberated if there was present more than 0.05 grms. of potassium bromide in 20 cc. of solution. Such a quantity is about 1,000 times the usual quantity of iodine observed, and it has been assumed that in the samples tested there has been considerably less than this amount of bromide present. The method

used to remove the other salts and described in the next paragraph will not eliminate small quantities of potassium bromide, but the maximum quantity of salts remaining was never as great as 0.05 grms., so that the possibility of interference from bromides was negatived.

The excess of other salts was removed by successive precipitations, with absolute alcohol. (Note: Solubility of sodium iodide in absolute alcohol at 10° is 46%, of potassium iodide only 4%.)

Ignition.—After the removal of the salts the solution was evaporated to dryness in a platinum dish, and ignited. As any trace of organic matter may destroy the test, it is necessary to maintain the ignition at a dull red for several minutes. If the solution, on taking it up with hot water, is not clear, it must be again evaporated and ignited.

Nitrites.—In comparing the results obtained by distillation of tap-water with the results given by other methods, the quantity of iodine came out far too high. This was found to be due to traces of nitrite remaining after ignition.

The first method employed to overcome this difficulty was to remove the nitrite before precipitation. This was done by boiling the solution for several minutes with excess of ammonium chloride until the test for nitrite failed. The ammonium chloride was then removed by boiling with potassium hydroxide, the cooled solution made just acid with dilute hydrochloric acid, and finally alkaline again with two drops of potassium hydroxide. The salts were then removed as before.

This method proved satisfactory provided no nitrates were present; but if there were any, their partial decomposing during ignition produced further nitrites.

In order to overcome this difficulty the removal of the nitrite was left until after the ignition. It was found that, if the final solution after ignition was boiled for 5 or 10 minutes in small volume with three or four drops of ammonium chloride solution, the nitrite was completely destroyed. The small quantity of ammonium chloride did not prevent the distillation of the iodine, 10 drops of the particular ammonium chloride used allowed a complete distillation.

Verification.—Test experiments showed that the method was capable of consistent results. Samples (kindly prepared by Mr. J. Packer, lecturer of the chemical laboratory) containing nitrites, nitrates, iodide, solium chloride (excess), sulphates, small quantities of potassium bromide and sodium oleate (an unsaturated compound) as organic matter, were examined. The following results were obtained:—

Quantity in Unknown Solution	*Quantity Estimated*
8×10^{-5} grms.	8.5×10^{-5}
6.5×10^{-5} grms.	6.5
4.2	4.0
2.0	1.8

The estimation thus appears to be quite satisfactory over this range, and the colorimetric comparison accurate to within 5—10%,

provided the quantity of iodine is not too large. It is possible to detect four parts per million of iodine with this method.

The following example will illustrate the general method employed:—

Four gallons of water from Heathcote reservoir were made alkaline with sodium carbonate solution, and evaporated to about one litre. The precipitated carbonates were filtered off and washed, and the evaporation of the filtrate was continued in a large evaporating dish until salts began to crystallize out. The solution was then poured into three times its volume of 96% alcohol and left for two hours. It was then filtered and washed five times with 96% alcohol, five drops of potassium hydroxide were then added and the alcohol distilled off. A current of air was maintained through the liquid during the distillation to prevent bumping. The evaporation was then continued and the solution again precipitated, this time with absolute alcohol. After standing and filtering, two drops of potassium hydroxide were added and the process as before continued. After three precipitations the salts were removed and the solution was evaporated to dryness, covered with a watch glass, and the residue ignited at a dull red for about two minutes. The organic matter was plentiful but was completely destroyed. On taking up with 10 cc. of distilled water the solution was clear. A few drops of it were then tested with an acid-starch-iodide solution, and a blue coloration showed the presence of nitrite. This was completely destroyed after boiling the solution (volume 5 cc.) for five minutes with four drops of ammonium chloride solution. The sample was then placed in the distilling flask and 10 cc. of ferric chloride solution (equivalent to 0.05 grms.) being added, the iodine was distilled into 3 ccs. of starch-solution containing three drops of potassium iodide. The iodine liberated was greater than 7.5×10^{-5} and less than 8×10^{-5} grms., which gives a value of 7.7×10^{-5} grms. The iodine content was, therefore, 4.3×10^{-9} grms. cc.

The following table shows the goitre-incidence tabulated with the corresponding iodine-content of the water.

Source	*Goitre-Incidence*	*Iodine-content of Water grms. cc.*	*Remarks*
New Brighton	47	2.9×10^{-9}	
Heathcote	14	4.3	
Granity	25	2.0	Rainwater on sea coast.
West Christchurch	75	.6	
St. Albans	59	Less than .2	
Woolston	52	1.0	
East Christchurch	69	1.2	
Blackball	81	1.4	Rainwater; organic matter large.
Westport	46	1.0	River water.
Christchurch Tap Water	63	.2	
Lyttelton	40	3.8	

Although the results are few, the figures seem to show that where the iodine is above 2 x 10^{-9} grms. the goitre-incidence is reduced. The results also indicate that other factors must be taken into consideration, for the water-supplies of Lyttelton and Heathcote have the same source, namely Heathcote, but the goitre-incidence is different.

Mr. Carter's examination of the soils gives the comparative iodine-content of the Heathcote as 15 and of the Lytellton as 9. This small difference could hardly affect the question.

The fact that Blackball, which is several miles from the sea, 1.5 x 10^{-6} grms. cc. This is about 1000 times that obtained for the iodine-content of the air, it seems possible that the rainwater has obtained its iodine from this source. Gautier (*Bull. Soc. Chem.*, 1899 (3) 21, 456-463) has found that air from the sea contains about 0.017 mg. of iodine in 1,000 litres. A rough idea of the influence of this quantity may be obtained by assuming that on condensation of the water-vapour from this air to form rain, the iodine is removed in the solution. It will also be necessary to assume a constant supply of iodine from the sea. Under these conditions the rain-water would contain

$$\frac{0.017 \times 76 \times 22}{1000 \times 1000 \times 18}$$ grms. of iodine, which is equivalent to 1.5 x 10^{-6} grms. cc. This is about 1000 times that obtained for the Granity rainwater, so that, although the assumptions made may not be permissable, yet the iodine in the air should not be entirely neglected.

McClendon and Hathaway (*Journ. Am. Med. Assoc.*, 1668-72, 1924) found the iodine-retention to be about 0.012 mg. per day. Assuming that, in different ways, a person takes in three litres of Heathcote drinking water per day, the iodine obtained could be $3{,}000 \times 4 \times 10^{-9}$, which is 0.012 mg. per day.

The above investigation was carried out at the suggestion of Dr. C. C. Farr, under a grant from the New Zealand Institute.

In conclusion, I have to thank Dr. Farr and Dr. H. G. Denham for much encouragement and advice during the research, and Mr. J. Packer for advice in working up the method of iodine estimation. I have also to thank Dr. Telford, Dr. Fenwick and others who kindly obtained for me the samples of water, and supplied me with figures relating to goitre among school children in Canterbury.

A Problem in Boiler Corrosion.

By H. G. Denham.

[*Read before the Philosophical Institute of Canterbury, 2nd December, 1925; received by Editor, 31st December, 1925; issued separately, 8th March, 1927.*]

A large factory which derived its boiler water from a neighbouring creek flowing through granite country was considerably hampered by excessive corrosion of the boiler tubes. The water, although in itself apparently exceptionally good, was treated with a soda ash softener, yet the formation of scale persisted. An examination of a sample of scale revealed, even to the naked eye, bands of hard, dark material alternating with bands of almost pure iron oxide. It appeared that, whilst the salts were accumulating in the boiler prior to crystallization setting in, active corrosion had been going on—a not uncommon phenomenon—especially with a silicate scale.

Analysis of scale.

Silica	11.3%
Iron oxides	55.5
Calcium oxide	10.6
Magnesium oxide	4.7
Sulphuric anhydride	12.6
Chlorine	.2
Loss on ignition	5.1
	100.0

In order to obtain a truer conception of the nature of this scale, the table has been recalculated with the elimination of the iron, which, after all, has entered the scale from the boiler, and not from the water.

Composition of scale (iron being eliminated)

Magnesium chloride	0.7%
Magnesium silicate	25.7
Calcium silicate	9.1
Calcium sulphate	47.9
Free Silica	5.2
Loss on ignition	11.4
	100.0

The deposit is thus revealed to be essentially a silicate-gypsum scale. The presence of the latter calls for little comment, for its relatively low solubility will cause its precipitation during evaporation whenever a feedwater contains soluble sulphates and soluble calcium salts, but such a scale is in no way corrosive. On the other hand, silicate deposits are notoriously corrosive. To quote from a standard book on the subject (Paul, *Boiler Chemistry,* p. 86) "a silicate scale one-sixteenth of an inch thick will cause tubes to fail in a few days." This arises, of course, from the action of the silicic acid in liberating its equivalent of mineral acids from the salts present. The formation

of this silicate scale postulates the presence in the boiler water of dissolved calcium and magnesium salts as well as of silicic acid.

The former of these may well have found its way into the boiler through leaky condenser tubes as the condenser was cooled with sea-water, but the comparative absence of silica in sea-water, as well as of sodium chloride in the scale, rules out such a possibility. The feed water itself becomes an object of suspicion.

Analysis of Feed Water.

Permanent Hardness		2 grains per Imp. Gallon
Temporary Hardness	less than	1 „ „ „ „
Reaction to litmus		neutral

On this analysis the water would pass as an eminently satisfactory boiler water, but it was deemed advisable to carry out a complete gravimitric analysis. The results were as follows:—

Total Residue	6.3 grains per Imp. Gallon.
Silica	2.52
Ferrous sulphate	0.39
Calcium sulphate	0.03
Calcium chloride	0.19
Magnesium sulphate	0.71
Organic and volatile matter	1.47
Nitrates	trace
Total	6.31 grains per Imp. Gallon.

The amount of silica present is roughly ten times that present in a normal feedwater, and this is in itself sufficient to account for the excessive corrosion experienced in the boiler. As evaporation has proceeded, the steady enrichment of silica and of the salts of calcium and magnesium in the boiler has led to the precipitation of the difficultly soluble and highly injurious silicates of these metals, accompanied by the relatively insoluble gypsum.

Treatment of the Feed-Water.—The unsatisfactory result given by the use of soda-ash may be attributed to the failure of this substance to remove from solution small quantities of magnesium salts. This can generally be more easily effected by means of an alkali, but the use of a lime-soda mixture would naturally be fraught with risk as the usual excess of the softener would enchance the possibility of precipitating calcium silicate. It was, therefore, decided to use a caustic soda-soda ash mixture. This would serve the double purpose of precipitating a good deal of the calcium and magnesium salts present and also impart sufficient alkalinity to the water to inhibit the corrosive action of the silicic acid. The formula of the softener calculated from the above feed water analysis is as follows:—

Soda ash (calculated as 100% pure) 2½ lbs. per 10,000 gallons.

Caustic soda (calculated as 100% pure and free of sulphides) 1½ lbs. per 10,000 gallons.

This formula has been in use in the factory for over a year and it is gratifying to record that the corrosion of the boiler has been entirely eliminated.

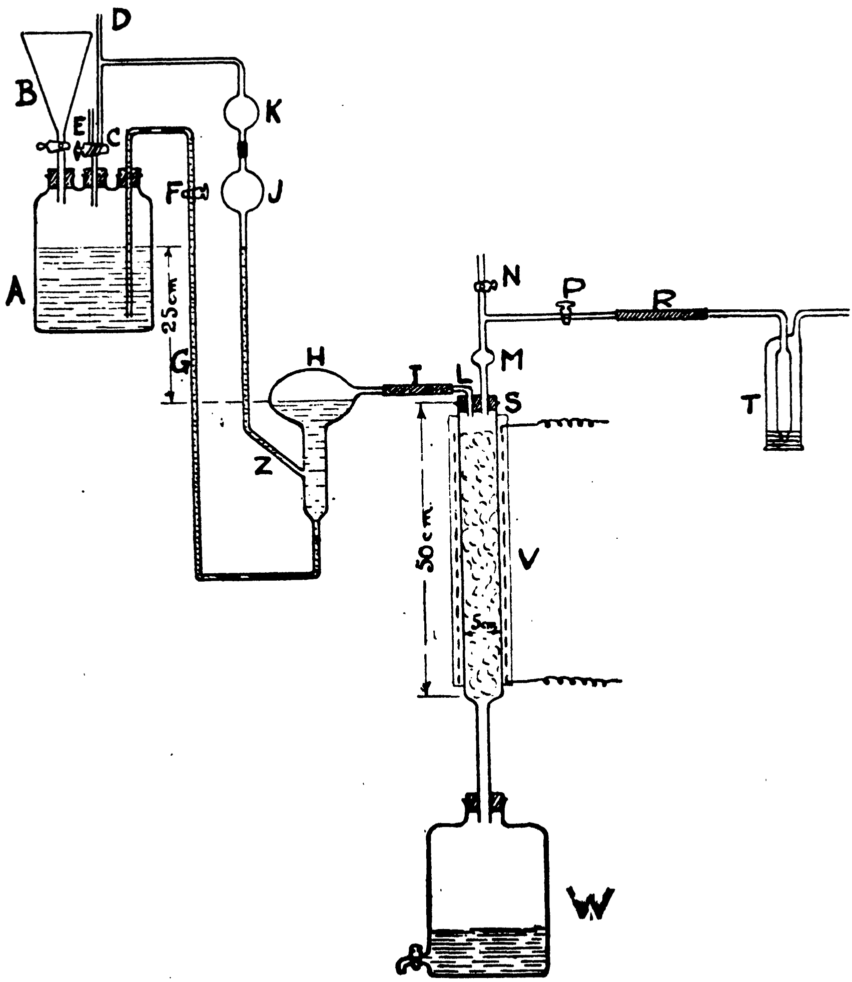
An Improved Hydrogen Sulphide Generator.

By H. G. Denham and John Packer.

[*Read before the Philosophical Institute of Canterbury, 2nd December, 1925; received by Editor, 31st December, 1925; issued separately, 8th March, 1927.*]

An automatic hydrogen sulphide generator for laboratory installation has been described by Steele and Denham (*Trans. Chemical Society,* 1920, vol. 117, p. 527). Since then the present authors have redesigned certain portions of the apparatus, and the modified generator has given such highly satisfactory results during constant use for the last two years, that a description of it has been considered justified. A chemical laboratory fitted with one of these generators would have a potential and practically unlimited supply of hydrogen sulphide always at hand at the negligible cost of the electric current needed to keep the generator heated.

The following is a description of the apparatus:—



A is the acid holder of about six litres capacity; B a tap funnel for use in filling A; C a two way tap so that A can be connected either to the tube D which leads to an outside flue, or to E to which is attached a length of rubber tubing (not shown); F is a large bore tap, situated at a higher level than the acid in A, by the turning off of which the flow of acid in the siphon G can be stopped; H is a reservoir of 600 to 700 c.c. capacity for retaining hydrogen sulphide generated but not withdrawn from the apparatus; J is a bulb of about 150 c.c. capacity, situated a few centimetres above the highest level of acid in A; K is 100 c.c. bulb; L is a piece of capillary tubing of 2 m.m. bore and of about 8 cm. total length, used to prevent a too rapid flow of acid when the taps are turned on, connected to the reservoir H by a piece of pressure tubing, I, which should be wired on; M is a small 10 c.c. bulb, N, P taps, R thick-walled rubber tubing, inserted for flexibility so that the rubber stopper S can be easily removed for recharging with sulphide; T is a wash-bottle, containing water, through which the hydrogen sulphide is supplied to the distributing taps and mains; V is a tube of fused silica, the upper portion of which is about 50 cm. long and 5 cm. internal diameter whilst the lower part is of 2 cm. internal diameter and fitted by a tight rubber stopper into the reservoir W, of six litres capacity which receives the spent acid; Y is a tap, through which the spent acid is withdrawn and which may conveniently be connected by a tube to a waste drain. The tube V is heated electrically.

In the authors' generator, the winding is made over a thin piece of asbestos paper with nichrome wire of one ohm per foot resistance, giving a total resistance of 100 ohms, and is well covered with many thicknesses of asbestos paper. This winding is connected through an ammeter and adjustable resistance to a 100 volt storage battery in such a way that by throwing over a switch the circuit either can be connected with the full battery of 110 volts or a portion of it, giving 60 volts. A current of just over 1 ampere is sufficient to heat the tube V up to working temperature in from 10 to 15 minutes while a current of .6 ampere will maintain it at a temperature suitable for operation of the generator. The rate of consumption of electrical energy for steady working of the generator is thus only about 36 watts, a neglegible quantity.

Mode of Operation.—The tube V is packed with lumps of iron sulphide. The acid holder is filled by means of the funnel B with commercial hydrochloric acid diluted with an equal volume of water, and the funnel tap turned off. The taps F and N are turned on and the tap C turned so as to connect the acid holder to E, through which air is blown (through means of a rubber tube connection) until the siphon G fills. Tap N is then turned off and tap E turned so as to connect the acid holder with the tube D. The reservoir H fills to the side tube level with acid, which then runs over into V and, provided the current has been switched on sufficiently long to heat V, hydrogen sulphide is generated as soon as a few drops run over and drives the acid back into H, where the hydrogen sulphide is stored till drawn off through the tap P and washbottle T. The acid is completely neutralized long before it has percolated through the heated column of sul-

phide. The side tube Z and bulbs J and K are provided as an escape for hydrogen sulphide should an excessive amount be generated owing to some abnormal cause such as the turning on of tap F (when starting up) before the tube V is sufficiently heated. This prevents hydrogen sulphide from getting into the siphon and putting the generator out of action. When the generator is not in operation and the tube V not heated, tap F is kept turned off.

General Remarks.—The capacity of this generator is practically the same as of the one formerly described, while for economy in acid and sulphide consumption it is even better, practically theoretical yields of hydrogen sulphide being always available at a steady and convenient pressure. It has the following advantages over the older form.

(1) It is completely automatic in operation, needing no attention beyond turning on in the morning and off at night, and, of course, recharging with acid and sulphide at regular intervals (in the authors' case, once a week). From this point of view, electrical heating is a great advantage over steam heating, whilst the use of silica instead of glass for the tube V overcomes the trouble formerly experienced of cracking, due to alternate heating and cooling.

(2) There is complete absence of any acid leaks as acid never comes in contact with rubber stoppers or connections (except at I during a portion of the cycle of operations). The tap F is placed above the level of acid in A so as to completely eliminate any tendency of acid to leak around it.

(3) Provided the tube D is carried to a suitable flue, there is no smell of hydrogen sulphide about the generator which may, therefore, be installed unenclosed in a suitable position in the laboratory.

The hydrogen sulphide is distributed throughout this building in composition (lead) gas pipes of ¼ inch internal diameter without any serious loss of pressure. After three years, the attack on these pipes appears hardly to have penetrated beyond the inner surface, although in the experience of one of the authors at Brisbane, of subtropical climate, these pipes were seriously attacked, but this could probably be overcome by the use of drawn copper tube.

Popular Names of New Zealand Plants.

Part 2.

By JOHANNES C. ANDERSEN, F.N.Z.Inst.

[*Read at the New Zealand Institute Science Congress, Palmerston North, January, 1921; received by Editor, 22nd August, 1924; issued separately, 8th March, 1927.*]

THE first part of this list, giving the scientific names of the plants with the various popular names under each, appeared in the *Transactions of the New Zealand Institute,* vol. 56, 1926. The present part contains a list of the popular names, with the different scientific names under each, and chronological references to authorities, which show when the popular name was first used, and how long and how much it was used. The name "broadleaf," for instance, appears as two words, broad leaf, from the year 1867 to the year 1882; as a compound word, broad-leaf, from 1844 to 1908; and as a single word, broadleaf, from 1889 to the present time;—that is so far as recorded instances go.

The list of popular names is followed by a list of authorities quoted. A great many more books than these have been read or consulted, but only those from which names have been quoted are included in the list.

A very great deal must still be done not only in the collection of printed names, but especially in the collection of names in the vernacular;—the names in the list following are almost entirely from printed literature. A remark by Baron von Mueller (MSE p. viii) may be quoted:—"Vernaculars have been but sparingly used, being so often of duplicity or multiplicity in their application, and so frequently also misleading." Vernacular names must naturally be presumed to be without hyphens in compound words, pronunciation being no sufficient or certain guide.

An explanation must be made of the manner in which the names have been arranged. An arrangement on the ordinary index plan could hardly be followed; for if black pine, red pine, silver beech, were arranged

pine, black
pine, red
beech, silver

then black-pine, red-pine, and silver-beech would introduce disorder; for even were the hyphen neglected in these instances, it would still prove an apple of discord since words like blue bell and bluebell, broad leaf and broadleaf would appear in different places

bell, blue
bluebell
broadleaf
leaf, broad

The names have therefore been placed under the first word of the name in every instance

black pine
black-pine
blue bell
bluebell
broad leaf
broadleaf
round-leaved willowherb
tiny eyebright
etc., etc.

In the introductory essay of the first part a remark was made on the acuteness of Maori observation and the reliability of his nomenclature, and T. W. Kirk was quoted on the singular exception in the case of the beeches, which the Maori seemed to class together as *tawhai* adding, perhaps, in our own manner, a descriptive modifying word or words, as *tawhairaunui* for the large-leaved beech. The recent studies of Dr. L. Cockayne*, show that in this, too, the Maori was right; the rigid specific distinction does not exist. As in *Hebe* (*Veronica*) there is much hybridization, so apparently there is in *Fagus* or *Nothofagus;* and as the *Veronicas* were all *koromiko* to the Maori, so the varieties of *Nothofagus* were all *tawhai.*

I must note that it has been pointed out to me that I have mixed the Greek at p. 671 of Part 1 of this paper, transposing the meanings of *Noto* and *Notho;* the former should be " south," the latter " false."

In conclusion I wish particularly to thank Dr. L. Cockayne for his ever-ready help in keeping me straight on the thorny path of scientific nomenclature, and in sustaining my interest with his living and poetic treatment of the vegetation of New Zealand. From many other naturalists, too, I have had constant help, and to all I tender my thanks.

acerose coprosma
Coprosma acerosa
LB, 1906.

acute-leaved totara
Podocarpus acutifolius
KFF, 1889.

adder's-tongue
Ophioglossum
TFF, 1882.

adder's-tongue
Ophioglossum coriaceum
CKB, 1915.

adder's tongue fern
adder's-tongue fern
Ophioglossum vulgatum
FFN, 1890.

Adders' Tongue
O. vulgatum
DFN, 1921.

African maidenhair
Adiantum aethiopicum
FFN, 1890.

alpine astelia
Astelia montana
CNZ, 1919.

alpine avens
Geum uniflorum
CNZ, 1919.

alpine bent grass
Agrostis Muelleri
CIG, 1880.

alpine bent grass
Deyeuxia (= *Agrostis*) *setifolia*
CIG, 1880.

alpine bent-grass
Agrostis Muelleri
CTP, 1908.
Calamagrostis setifolia
CSI, 1909.

alpine broom
Carmichaelia grandiflora var. *alba*
CCO, 1900.

alpine bush-flax
Astelia montana
CSI, 1909.

*" Monograph on the New Zealand Beech Forests: Part 1, The Ecology of the Forests and Taxonomy of the Beeches." New Zealand State Forest Service, Bulletin No. 4, Wellington, 1926.

alpine carpha
Carpha alpina
CSI, 1909.

alpine celery pine
Phyllocladus alpinus
DCO, 1900.
CNZ, 1919.

alpine celery-pine
Phyllocladus alpinus
CNZ, 1919.

alpine club-moss
Lycopodium fastigiatum
CTP, 1908
THW, 1909
CNZ, 1919

alpine creeping coprosma
Coprosma repens
CTP, 1908.

alpine donatia
Donatia novae-zelandiae
CNZ, 1919.

alpine epacris
Epacris alpina
CTP, 1908.

alpine eyebright
Euphrasia Monroi
CNZ, 1919.

alpine fern
Polystichum cystostegium
NZCJ, 1885.

alpine filmy fern
Hymenophyllum villosum
CSI, 1909.

alpine foxglove
Ourisia macrophylla
CNZ, 1919.

alpine hard fern
Blechnum penna marinum
LFN, 1875
POO, 1882
CTP, 1908

alpine hard-fern
Blechnum penna marinum
CNZ, 1919.

alpine holy grass
Hierochloe Fraseri
CTP, 1908.

alpine holy-grass
Hierochloe Fraseri
CSI, 1009.

alpine marigold
Senecio family
FAA, 1889.

alpine oat grass
Danthonia semiannularis
CIG, 1880.

alpine oat-grass
Danthonia crassiuscula
CSI, 1909.

alpine quillwort
Isoetes alpinus
CNZ, 1910.

alpine ribbonwood
Plagianthus Lyallii
CCV, 1872.

alpine rice grass
Microlaena Colensoi
CIG, 1880.

alpine rue-leaved fern
Gymnogramme rutaefolia
POO, 1882.

alpine rush
Juncus novae zelandiae
CTP, 1908.

alpine shield fern
Polystichum cystostegium
POO, 1882.
CTP, 1908.

alpine shield-fern
Polystichum cystostegia
CSI, 1909.
DMs., 1921.

alpine spear grass
Aciphylla Monroi
HGC, 1865.

alpine sun-dew
Drosera Arcturi
CSI, 1909.

alpine sundew
Drosera Arcturi
FAA, 1889.
CTP, 1908.
THW, 1909.

alpine tangle-fern
Gleichenia alpina
POO, 1882.
CSI, 1909.
DMs., 1921.

alpine totara
Podocarpus Hallii
OTR, 1916.
DDD (2), 1925.
Padocarpus nivalis
KFF, 1889.
CNZ, 1919.

alpine tutu
Coriaria thymifolia
TNN, 1909.

alpine umbrella fern
Gleichenia alpina
CTP, 1908.

alpine umbrella-fern
Gleichenia alpina
CSI, 1909.

alpine whorl grass
Deschampsia tenella

American marsh-pennywort
Hydrocotyle americana
CKI, 1907.
CSI, 1909.
CDA, 1911.
CKB, 1915.

American water wort
Elatine americana
FAA, 1889.

anis
Angelica montana
ASC, 1853.

anise
Angelica montana
CNZ, 1919.

aniseed
Angelica montana
TIM, 1855.
CMN, 1906.
LB, 1906.
CNZ, 1910.
CCN, 1924.
Angelica Gingidium
KSF, 1899.
CMN, 1906.

aniseed
Angelica rosaefolia
DDD (2) 1925.

annual herbaceous tutu
Coriaria angustissima
FAA, 1889.

anomalous nothopanax
Nothopanax anomalum
LB, 1906.

Antarctic burr
Acaena Sanguisorbae var. *minor*
CNZ, 1910.

Antarctic club-rush
Scirpus antarcticus
CSI, 1909.

Antarctic eyebright
Euphrasia zealandica
LB, 1906.

Antarctic mistletoe
Tupeia antarctica
CKI, 1907.

Antarctic piripiri
Acaena Sanguisorbae var. *minor*
CNZ, 1919.

Antarctic rush
Juncus antarcticus
CTP, 1908.

Antarctic tree-daisy
Olearia Lyallii
CNZ, 1919.

Antarctic tupeia
Tupeia antarctica
LB, 1906.

antipodes chickweed
Stellaria decipiens var. *angustata*
CNZ, 1919.

antler fern
Lycopodium volubile
SLM, 1902.

areolate coprosma
Coprosma areolata
LB, 1906.

Armstrong's fern
Hymenophyllum Armstrongii
POO, 1882.

aromatic-leaved maireire
Phebalium nudum
CNZ, 1919.

arrow grass
Triglochin triandrum
Trans. 1, 1869.

ash-leaf fern
Maratta fraxinea
POO, 1882.

Asiatic hydrocotyle
Hydrocotyle asiatica
LB, 1906.

Asiatic marsh pennywort
Hydrocotyle asiatica
CWK, 1908.

Asiatic marsh-pennywort
Hydrocotyle asiatica
CKI, 1907.
CSI, 1909.
CDA, 1911.

asphodel
Cordyline australis
DRA, 1872.

aster
Celmisia haloserícea
TIM, 1855.

Auckland Island club-rush
Scirpus aucklandicus
CSI, 1909.

Auckland Islands poa
Poa foliosa
CIG, 1880.

Auckland tree-daisy
Olearia albida
CNZ, 1919.

austral broom
Carmichaelia australis
CNZ, 1919.

austral-broom
Carmichaelia australis
CNZ, 1919.

Australian bent grass
Deyeuxia Petriei
CIG, 1880.

Australian celery
Apium prostratum
MSE, 1888.

Australian club-moss
Lycopodium Drummondii
CNZ, 1919.

Australian glasswort
Salicornia australis
CNZ, 1919.

Australian gourd
Sicyos australis
CNZ, 1919.

Australian piripiri
Acaena ovina
CNZ, 1919.

Australian sea-holly
Eryngium vesiculosum
CNZ, 1919.

Australian sea-rush
Juncus maritimus var. *australiensis*
CNZ, 1919.

Australian spike-rush
Elaeocharis acuta
CWK, 1908.
Elaeocharis Cunninghamii
CKI, 1907.

avens
Geum parviflorum
Trans. 1, 1869.

avicennia-leaved olearia
Olearia avicenniaefolia
LB, 1906.

awned shield fern
Polystichum aristatum
POO, 1882.

axil-flowered drimys
Wintera (= Drimys) axillaris
LB, 1906.

axillary-flowered Mühlenbeckia
Muehlenbeckia axillaris
LB, 1906.

Bank's coprosma
Coprosma Banksii
CTP, 1908.

Bank's hard fern
Blechnum Banksii
POO, 1882.
CSI, 1909.

Banks' pterostylis
Pterostylis Banksii
LB, 1906.

basket fungus
Clathrus cibarius
NZJS, 1922.

bastard sandal-wood-tree
Olearia Traversii
HHN, 1867
HFF, 1889.

bastard sandalwood tree
Olearia Traversii
MVC, 1864.

bastard totara
Libocedrus Doniana
Ver. (WB).

bayonet grass
Aciphylla Colensoi
Trans. 1, 1869.

bayonet-grass
Aciphylla Colensoi
KSF, 1899.
Danthonia pungens
CSI, 1909.

bayonet plant
Aciphylla Colensoi
„ *Lyallii*
MHG, 1885
„ *squarrosa*
NZCJ, 1885

bayonette-grass
Aciphylla Colensoi
LCN, 1868.

beach spinach
Tetragonia trigyna
NZCJ, 1888.

bearded mousetail
Myosurus aristatus
FAA, 1889.

beautiful filmy fern
Hymenophyllum pulcherrimum
POO, 1882

bed straw
Galium tenuicaule
Trans. 1, 1869.

bedstraw
Galium
CNZ, 1919.

beech
Fagus Menzieseii
OTR, 1916.

beech tree
Fagus
POO, 1882.

bell climber
Calystegia sepium
Ver. (Manawatu)

bell-flower
Wahlenbergia gracilis
HNP, 1867.
Wahlenbergia Matthewsii
CNZ, 1919.

bell-vine
Calystegia sepium
CNZ, 1919.

beta-beta
Acaena Sanguisorbae
LCN, 1868.

bid-a-bid
Acaena Sanguisorbae
TIC, 1906.
TNN, 1909.

biddy-bid
Acaena Sanguisorbae
CNZ, 1909.
Ver.

biddy-biddy
Acaena Sanguisorbae
NZCJ, 1888.

biddybiddy
Acaena Sanguisorbae

bidi-bid
Acaena Sanguisorbae
LB, 1906.

bidi-bidi
Acaena Sanguisorbae
LCN, 1868.
LB, 1906.

Bidwill's libocedrus
Libocedrus Bidwillii
LB, 1906.

Bidwill's shrubby groundsel
Senecio Bidwillii
CTP, 1908.

big-fruited pratia
Pratia arenaria
CDA, 1911.

Billiardier's bent grass
Deyeuxia Billardieri
CIG, 1880.

Billardier's polypody
Polypodium diversifolium
LFN, 1875.
POO, 1882.

bind-weed
Calystegia sepium
Trans. 2, 1870.

bindweed
Calystegia sepium
TIM, 1855.
HHN, 1867.
NZCJ, 1886.
CMN, 1906.
LB, 1906.
TIC, 1906.
Calystegia soldanella
CDA, 1911.

birch
See Black birch, Brown birch, etc.

birch-like ribbonwood
Plagianthus betulinus
LB, 1906.

bird-catcher
Pisonia Brunoniana
NZJS, 1924.

bird-catcher plant
Pisonia Brunoniana
NZJS, 1924.

bird catching plant
Pisonia Brunoniana
DDD, 1917.

bird-catching plant
Pisonia Brunoniana
KFF, 1889.
LB, 1906.

bitter-cress
Cardamine heterophylla
TNN, 1909.
DFC, 1916.

black akeake
Dodonoea viscosa
Ver. (WB).

black ash
Nothopanax arboreum
Ver. (WB).

black beech
Nothofagus fusca
HGC, 1865.
PPO, 1868.
Nothofagus Solanderi
DDD, 1917.

black-beech
Nothofagus Solanderi
THW, 1909.

black birch
Nothofagus Cliffortioides
Trans. 17, 1885.
KFF, 1889.
HMB, 1898.
Nothofagus fusca
HGC, 1865.
Trans. 17, 1885.
KFF, 1889.
CMN, 1906.
Nothofagus Solanderi
WNZ, 1845.
TNC, 1856.
PPO, 1868.
Trans. 1, 1869.
CCV, 1872.
Trans. 17, 1885.
KFF, 1889.
CMN, 1906.
Ver. (WB).
Pittosporum tenuifolium
RDT, 1875.
Wienmannia racemosa
RDT, 1875.
Trans. 9, 1877.
FAA, 1889.

black-birch
Nothofagus cliffortioides
MNZ, 1905.

black bristle fern
Trichomanes elongatum
CWK, 1908.

black daisy
Cotula atrata
DCO, 1900.

black-fern
Cyathea medullaris
TFF, 1882.

black hard fern
Blechnum nigrum
POO, 1882.
CWK, 1908.

black hard-fern
Blechnum nigrum
CNZ, 1919.

black-heart birch
Nothofagus Solanderi
Trans. 9, 1877.
Trans. 17, 1885.
KFF, 1889.

black hinau
Elaeocarpus dentatus
Ver. (WB).

black maire
Eugenia maire
RDT, 1875.
Olea apetala
RDT, 1875.
Olea Cunninghamii
KFF, 1889.
CMN, 1906.
LLB, 1906.
THW, 1909.
DDD, 1917.

black maire
Olea lanceolata
Ver. (W.B.)

black-maire
Olea Cunninghamii
MNZ, 1905.

blackmaire
Olea Cunninghamii
HRN, 1889.

black mapau
Pittosporum Colensoi
Trans. 9, 1877.
Pittosporum eugenioides
CCV, 1872.
Pittosporum tenuifolium
RDT, 1875.
Trans. 9, 1877.
TNN, 1909.

black maple
Pittosporum tenuifolium
KFF, 1889.

black mapou
Pittosporum tenuifolium
KFF, 1889.
Rapanea Urvilleii
KFF, 1889.

black nightshade
Solanum nigrum
LB, 1906.

black pine
Dacrydium cupressinum
HGC, 1865.

black pine
Podocarpus ferruginea
HHN, 1867.
PPO, 1868.
Trans. 1, 1869.
RDT, 1875.
KFF, 1889.
CMN, 1906.

black pine
Podocarpus spicatus
PPO, 1868.
CCV, 1872.
HRN, 1889.
KFF, 1889.
LB, 1906.
DDD (2), 1925.

black-pine
Podocarpus ferrugineus
CSI, 1909.
THW, 1909.
Podocarpus spicatus
MNZ, 1905.
TIC, 1908.
CWK, 1908.
CSI, 1909.
THW, 1909.
CKB, 1915.

blackpine
Nothofagus fusca
HRN, 1889.

black rue
Podocarpus spicatus
HHN, 1867.
Trans. 9, 1877.

black rue pine
Podocarpus spicatus
Trans. 1, 1869.

black shield fern
Polystichum Richardi
POO, 1882.
CTP, 1908.

black shield-fern
Polystichum Richardi
CKB, 1915.

black southern-beech
Nothofagus Solanderi
CNZ, 1919.
CCN, 1924.

black tree fern
Cyathea medullaris
LFN, 1875.
FFN, 1890.
CMN, 1906.
OTR, 1916.
DDD (2), 1925.
Ver. (WB).

black tree-fern
Cyathea medulloris
POO, 1882.
FFN, 1890.
THW, 1909.
CNZ, 1910.
CNZ, 1919.
DFN, 1921.
CCN, 1924.

black vine
Muehlenbeckia adpressa
EM, 1912.
Rhipogonum scandens
Trans. 1, 1869.

bladder fern
Cystopteris fragilis
POO, 1882.

bladder-fern
Cystopteris fragilis
TFF, 1882.

bladder-wort
Utricularia monanthos
Trans. 17, 1885.

bladderwort
Utricularia monanthos
DCO, 1900.
TIC, 1906.
CNZ, 1910.
CNZ, 1919.
Utricularia protrusa
Trans. 43, 1911.

Blair's beech
Nothofagus Blairii
KFF, 1889.

blistered-leaved myrtle
Myrtus bullata
CWK, 1908.

bloody Spaniard
Aciphylla Colensoi
LCN, 1868.

bloody-Spaniard
Aciphylla Colensoi
LCN, 1868.

blotched-leaved pepper-tree
Wintera (= Drimys) colorata
CKB, 1915.

blue bell
Wahlenbergia albomarginata
HNF, 1888.
HRN, 1889.
Wahlenbergia gracilis
LCN, 1868.
Trans. 2, 1870.

blue-bell
Wahlenbergia albomarginata
HHN, 1867.
Wahlenbergia gracilis
TIM, 1855.
BNZ, 1878.

bluebell
Wahlenbergia albomarginata
CTP, 1908.
THW, 1908.
Wahlenbergia gracilis
CNZ, 1910.

blue berry
Dianella intermedia
HNB, 1890.
CWK, 1908.
OTR, 1916.
DDD, 1917.

blueberry
Dianella intermedia
CTP, 1908.
THW, 1909.

blue grass
Agropyron scabrum
GST, 1921.
**Agropyron squarrosum*
NZCJ, 1879.
Agropyron Youngii
NZCJ, 1879.

blue-grass
Agropyron scabrum
CTP, 1908.
CSI, 1909.
THW, 1909.
CNZ, 1910.
CKB, 1915.
CNZ, 1919.
NZJS, 1923.

blue thelymitra
Thelymitra uniflora
CSI, 1909.

blue tussock
Poa Colensoi
CTP, 1908.

blue-tussock
Poa Colensoi
THW, 1909.
CNZ, 1910.
CKB, 1915.
NZJS, 1923.

blue tussock-grass
Poa colensoi
CSI, 1909.

blue wheat grass
Agropyron scabrum
CIG, 1880.

blunt leafed spleenwort
Asplenium obtusatum
LFN, 1875.

blunt-leaved spaniard
Celmisia Lyallii
HHN, 1867.
KSF, 1899.

blunt spaniard
Celmisia Lyallii
Z, 1889.

blushing convolvulus
Convolvulus erubescens
LB, 1906.

boa
Freycinetia Banksii
NZCJ, 1878.

boat-leaved tree-daisy
Olearia cymbifolia
CNZ, 1919.

bocarro
Elaeocarpus Hookerianus
HHN, 1867.

bog-anise
Angelica trifoliata
CNZ, 1919.

bog bent-grass
Calamagrostis setifolia
CTP, 1908.

bog celmisia
Celmisia glandulosa var. latifolia
CTP, 1908.

bog-celmisia
Celmisia glandulosa
THW, 1909.
CNZ, 1919.

bog club-moss
Lycopodium laterale
CWK, 1908.

bog-cushion
Gaimardia ciliata
CNZ, 1919.

bog-epacris
Epacris pauciflora
CNZ, 1919.

bog-gentian
Gentiana Townsoni
CNZ, 1919.

bog-heath
Dracophyllum paludosum
CNZ, 1919.

bog-lily
Chrysobactron Hookeri var. *angustifolium*
CNZ, 1919.
(an error = swamp-lily)

bog-moss
Sphagnum
CNZ, 1910.

bog pincushion
Gaimardia ciliata
CSI, 1909.

bog-pincushion
Gaimardia ciliata
CSI, 1909.

bog pine
Dacrydium Bidwillii
KFF, 1889.
Dacrydium Colensoi
DFC, 1896.

bog-pine
Dacrydium Bidwillii
Trans. 43, 1911.

bog-poa
Poa chathamica
CNZ, 1919.

bog rush
Schoenus pauciflorus
Trans. 1, 1869.

bog umbrella fern
Gleichenia dicarpa
CTP, 1908.

bog umbrella-fern
Gleichenia dicarpa
CSI, 1909.
THW, 1909.
CNZ, 1910.
CNZ, 1919.

bokaka
Elaeocarpus Hookerianus
MSO, 1878.
ATO, 1897.

bokako
Elaeocarpus dentatus
CCV, 1872.
Elaeocarpus Hookerianus
HHN, 1867.
MLN, 1890.

boradi
Vitex lucens
LB, 1906.

borra borra
Solanum aviculare
RSC, 1844.

*No such name now recognised; perhaps a syn. for *A. scabrum*.

box-leaved koromiko
Veronica buxifolia
CNZ, 1919.

box-leaved pimelea
Pimelea buxifolia
CTP, 1908.
CNZ, 1919.

box-leaved veronica
Veronica buxifolia var. *odora*
CSI, 1909.
CNZ, 1919.

box rata
Metrosideros scandens
DDD, 1917.
DDD (2), 1925.

bracken
Pteridium esculentum
TFF, 1882.
POO, 1882.
FO, 1886.
FFN, 1890.
LB, 1906.
THW, 1909.
EM, 1911.
Trans. 44, 1912.
DFC, 1916.
DFN, 1921.

bracken fern
Pteridium esculentum
VTN, 1896.
DCO, 1900.
THW, 1909.
CNZ, 1910.

bracken-fern
Pteridium esculentum
CNZ, 1910.
CDA, 1911.
CNZ, 1919.

brake
Pteridium esculentum
TFF, 1882.
POO, 1882.
FFN, 1890.

bramble
Rubus australis
CSJ, 1846.
NZJ, 1848.
MOA, 1852.
ASC, 1853.
Trans. 1, 1869.
TIC, 1906.
TNN, 1909.
Trans. 44, 1911.

branch-flowered melicytus.
Melicytus ramiflorus
LB, 1906.

bran-like olearia
Olearia furfuracea
LB, 1906.

breasted raoulia
Raoulia mammillaris
LB, 1906.

brexia-like ixerba
Ixerba brexioides
LB, 1906.

briar
Rubus australis
HCE, 1844,

bridal tree
Pennantia corymbosa
Ver. (A).

bristle fern
Trichomanes
POO, 1882.

bristle-fern
T. elongatum
DMS, 1921.

bristly ligusticum
Anisotome piliferum
LB, 1906.

brittle bladder fern
Cystopteris fragilis
LFN, 1875.
POO, 1882.

brittle bladder-fern
Cystopteris novae-zelandiae
POO, 1882.
FFN, 1890.

broad comb fern
Schizaea dichotoma
POO, 1882.

broad leaf
Griselinia littoralis
HHN, 1867.
Trans. 1, 1869.
2, 1870.
POO, 1882.
Griselinia lucida
Trans. 2, 1870.

broad-leaf
Coprosma lucida
LCN, 1868.
Griselinia littoralis
HCE, 1844.
Trans. 3, 1871.
NZCJ, 1878.
KFF, 1889.
CMN, 1906.
MK, 1908.

broadleaf
Griselinia littoralis
HRN, 1889.
DFC, 1896.
DCO, 1900.
MNZ, 1905.
LB, 1906.
TIC, 1906.
CKI, 1907.
THW, 1909.
Trans. 42, 1910.
TNN, 1909.
CNZ, 1910.
Trans. 44, 1912.
NC, 1912.
HEC, 1915.
DFC, 1916.
CNZ, 1919.
GST, 1921.
NZJS, 1921.
CCN, 1924.
Griselinia lucida.
OTR, 1916.

broad-leaf cabbage tree
Cordyline indivisa
NC, 1912.

broad-leaved cabbage-tree
Cordyline indivisa
CTP, 1908.
CNZ, 1919.

broad-leaved cattle grass
Hierochloe redolens
NZCJ, 1879.

broad-leaved filmy fern
Hymenophyllum dilatatum
POO, 1882.
CWK, 1908.
CKB, 1915.

broad-leaved grass-tree
Dracophyllum latifolium
LB, 1906.

broad-leaved hard-fern
Blechnum Patersoni
DMs., 1921.

broad-leaved ligusticum
Anisotome latifolium
LB, 1906.

broad-leaved lindsaya
Lindsaya trichomanoides
POO, 1882.
CWK, 1908.

broad-leaved maire
Olea apetala
MNZ, 1905.
NZJS, 1925.

broad-leaved oat tussac grass
Danthonia flavescens
CIG, 1880.

broad-leaved poa
Poa anceps
ONZ, 1919.

broad-leaved puhepuhe
Muehlenbeckia australis
CNZ, 1919.

broad-leaved snow-grass
Danthonia flavescens
CNZ, 1919.

broad-leaved tussock oat-grass
Danthonia flavescens
CSI, 1909.

broad-leaved uncinia
Uncinia uncinata
CTP, 1908.

bronze forget-me-not
Myosotis macrantha
CNZ, 1919.

bronze-leaved fern
Blechnum paleacea
POO, 1882.

bronze panax
Pseudopanax discolor
DDD, 1917.
DDD (2), 1925.

*brown backs
Senecis elaeagnifolium
HNF, 1888.

brown bent
Agrostis Dyeri
NZCJ, 1879.

brown bent grass
Agrostis Dyeri
CIG, 1880.

brown birch
Nothofagus Menziesii
Trans. 17, 1885.
KFF, 1889.
Nothofagus Solanderi
Trans. 17, 1885.
KFF, 1889.
Wienmannia racemosa
KFF, 1889.

brown fern
Pteridium esculentum
Trans. 1, 1869.

brown-flowered poa
Poa Lindsayi
CIG, 1880

brown hypolepis
Hypolepis distans
POO, 1882.
CWK, 1908.

brown mountain daisy
Celmisia Traversii
KSF, 1899.

brown mountain poa
Poa Kirkii var. *Mackayi*
CIG, 1880.

Brown's plantain
Plantago Brownii
CSI, 1909.

brown-stemmed maidenhair
Adiantum fulvum
POO, 1882.
CWK, 1908.

Buchanan's oat grass
Danthonia Buchanani
CIG, 1880.

buckerteer
Laurelia novae zelandiae
Ver. (WB).

bucket of water wood
Pittosporum tenuifolium
FAA, 1889.

bucket-of-water wood
Fuscia excorticata
CNZ, 1910.

buddleia-like corokia
Corokia buddleoides
LB, 1906.

bukitea
Laurelia novae zelandiae
HNR, 1842.

bulabul
Solanum aviculare
Ver. (WB).

bul-bul
Solanum aviculare
TNC, 1856.

bull birch
Nothofagus fusca
Trans. 17, 1885.
KFF, 1889.

bulli-bull
Solanum aviculare
LB, 1906.
NZJS, 1923.

bulli bulli
Solanum aviculare
MLN, 1890.

bulli-bulli
Solanum aviculare
DFC, 1896.
LB, 1906.
TNN, 1909.

bullibulli
Solanum aviculare
TIC, 1906.

bull-kelp
Durvillaea utilis
CSI, 1909.
CNZ, 1919.

bullrush
Typha angustifolia
TCS, 1851.
TIC, 1906.

bullybull
Solanum aviculare
Ver.

bullrush
Typha angustifolia
WNZ, 1845.
TCS, 1851.
HHN, 1867.
Trans. 1, 1869.
DFC, 1896.
Trans 20, 1888.
DCO, 1900.
CMN, 1906.
CWK, 1908.
THW, 1909.
DFC, 1916.
CNZ, 1919.

bundle-flowered lecuopogon.
Leucopogon fasciculatum
LB, 1906.

bunga-bunga
Cyathea dealbata
BOS, 1900.

bunger (or bunga, in DFN, 1921.)
Ver.

burr
Acaena Sanguisarbae
WAH, c.1833.
HHN, 1867.
Trans. 2, 1870.

burra burra
Solanum aviculare
Ver. (WB)

bush flax
Astelia nervosa
MHG, 1885
CKI, 1907.

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*Because of the brown hairs on the backs of the leaves.

bush-flax
Astelia nervosa
CTP, 1908.
THW, 1909.
CKB, 1915.

bush lawyer
Rubus australis
POO, 1882.
FAA, 1889.
DFC, 1896.
LB, 1906.
TNN, 1909.
Ver. (WB).

bush-lawyer
Rubus australis
ASC, 1853.
TNC, 1856.
Z, 1890.
KSF, 1899.
CMN, 1906.
CWK, 1908.
THW, 1909.
DFC, 1916.
CNZ, 1919.
CCN, 1924.
Rubus cissoides
THW, 1909.
Rubus schmideloides
THW, 1909.

bushlawyer
Rubus australis
HGC, 1879.

bush-lily
Astelia nervosa
DCO, 1900.

bush manuka
Leptospermum ericoides
Trans. 3, 1871.

bush myrtle
Myrtus bullata
Ver. (WB)

bush-nettle
Urtica ferox
DCO, 1900.

bush oat-grass
Microlaena avenacea
THW, 1909.

bush rice grass
Microlaena avenacea
CIG, 1880.

bush rice-grass
Microlaena avenacea
CTP, 1908.
CWK, 1908.
CSI, 1909.

bush sarsaparilla
Rhipogonum scandens
LB, 1906.

bush umbrella-fern
Gleichenia Cunninghamii
THW, 1909.

butter cup
Ranunculus lappaceus
Trans. 2, 1870.

buttercup
Ranunculus lappaceus
TIM, 1855.

cabbage palm
Cordyline australis
CVN, 1774.
LCN, 1868.
BOS, 1900.
OTR, 1916.
DDD, 1917.

cabbage-palm
Cordyline australis
BOS, 1900.
HNZ, 1905.

cabbage tree
Cordyline australis
CV, 1769-70.
CVS, 1773.
WNZ, 1845.
HLN, 1856.
BFY, 1863.
HNP, 1867.
Trans. 1, 1869.
PPO, 1868.
CSC, 1891.
HMB, 1898.
SLM, 1902.
LB, 1906.
CKI, 1907.
CWK, 1908.
MK, 1908.
Meryta Sinclairii
HNF, 1888.
HRN, 1889.

cabbage-tree
Cordyline australis
Trans. 1, 1869.
MNZ, 1905.
LB, 1906.
CNZ, 1910.
EM, 1911.
DFC, 1916.
CNZ, 1919.
GST, 1921.
CCN, 1924.

calabash
Lagenaria vulgaris
Trans. 29, 1897.

candle-nut
Aleurites moluccana
Trans. 20, 1888.
CMN, 1906.

candlenut
Aleurites moluccana
CNZ, 1910.
CNZ, 1919.

caper spurge
Euphorbia glauca
TNN, 1909.

capitate myosotis
Myosotis capitata
LB, 1906.

capsulate parsonsia
Parsonsia capularis
LB, 1906.

Captain Cook cabbage
Brassica oleracea
NZJS, 1921.

Captain Cook's ropes
Rubus australis
PPO, 1868.

caraceer
See cracker

carpet fern
Hymenophyllum demissum
DDD, 1917.
Paesia scaberula
Ver. (A).

carpet-grass
Danthonia australis
CMN, 1906.

carrot
Daucus brachiatus
Trans. 1, 1869.

carrot fern
Asplenium Richardi
NZCJ, 1885.

carrot-top
Asplenium bulbiferum
Ver. (D).

cat's tail
Typha angustifolia
Trans. 1, 1869.

caudie
Agathis australis
RSC, 1844.

cedar
Dysoxylum spectabile
KFF, 1889.
CWK, 1908.
Libocedrus Bidwillii
RDT, 1875.
Trans. 9, 1877.
KFF, 1889.
CMN, 1906.
CTP, 1908.
THW, 1909.
NZJS, 1921.
NZJS, 1923.

cedar
Libocedrus Doniana
Trans. 1, 1869.
Trans. 12, 1880.
Ver. (WB).
Olea Cunninghamii
PMC, 1840.

celery
Apium prostratum
Trans. 1, 1869.

celery-leaved pine.
Phyllocladus alpinus
Trans. 1, 1869.
DFC, 1916.
Phyllocladus trichomanoides
CMN, 1906.
LB, 1906.
CWK, 1908.

celery pine
Phyllocladus alpinus
Trans. 1, 1869.
KFF, 1889.

celery-pine
Phyllocladus glaucus
MNZ, 1905.
P. trichomanoides.
MSE, 1888.
MNZ, 1905.

celery topped pine
Phyllocladus alpinus
DFC, 1896.
DDD, 1917.

celery-topped pine
Phyllocladus alpinus
KFF, 1889.
P. trichomanoides
KFF, 1889.
NC, 1912.

celery top pine
P. trichomanoides
Ver. (WB).

Chatham akeake
Olearia Traversii
CNZ, 1919.
CCN, 1924.

Chatham cranesbill
Geranium Traversii
CNZ, 1919.

Chatham gentian
Gentiana chathamica
CNZ, 1919.

Chatham Island akeake
Olearia Traversii
CDA, 1911.

Chatham Island aster
Olearia semidentata
CNZ, 1910.

Chatham Island cranesbill
Geranium Traversii
CNZ, 1910.

Chatham Island fescue
Festuca Coxii
CDA, 1911

Chatham Island lily
Myosotidium nobile (hortensia)
Trans. 14, 1882.
MLN, 1890.
LB, 1906.
TIC, 1906.
CNZ, 1910.
NC, 1912
CNZ, 1919.
CCN, 1924.

Chatham Island matipo
Suttonia chathamica
CSI, 1909.
CDA, 1911.

Chatham Islands lily
Myosotidium nobile (hortensia)
NZCJ, 1885.
CMN, 1906.
DDD, 1917.
CCN, 1924.

Chatham-Islands lily
M. nobile
MVC, 1864.

Chatham Island sow-thistle.
Tonchus grandifolius
CDA, 1911.

Chatham kowhai
Sophora chathamica
CNZ, 1919.

Chatham lancewood
Pseudopanax chathamicum
CNZ, 1919.

Chatham mahoe
Hymenanthera chathamica
CNZ, 1919.

Chatham matipo
Suttonia chathamica
CNZ, 1919.

Chatham mingimingi
Cyathodes robusta
CNZ, 1919.

Chatham ribbonwood
Plagianthus chathamicus
CNZ, 1919.

Chatham tree-daisy
Olearia chathamica
CNZ, 1919.

Chatham tree-heath
Dracophyllum arboreum
CNZ, 1919.

Cheeseman's fern
Hymenophyllum Cheesemanii
POO, 1882.

Cheeseman's filmy fern
H. Cheesemanii
CSI, 1909.

Cheeseman's pond-weed
Potamogeton Cheesemanii
CSI, 1909.

Chenille fern
Leptopteris superba
FFN, 1890.

cherry pie
Ageratum conyzioides
Trans. 20, 1888.

cherry-pie
A. conyzioides
CNZ, 1910.
CNZ, 1919.

Christmas flower
Metrosideros tomentosa
KSF, 1899.

Christmas tree
Metrosideros tomentosa
MI, 1884.
BOS, 1900.
DDD, 1917.
CNZ, 1919.
Ver.

Christmas-tree
M. tomentosa
FAA, 1889.
KFF, 1889.
CMN, 1906.
CNZ, 1910.

chuckie chucks
Gaultheria fruits
NZCJ, 1856.

chuckiechuck
Gaultheria fruits
Trans. 3, 1871.

citron
Pittosporum eugenioides
Ver. (WB).

clasping mühlenbeckia
Muehlenbeckia complexa
LB, 1906.

clematis
Clematis indivisa
THW, 1909.

clifortia-like beech
Nothofagus cliffortioides
LB, 1906.

climbing-aniseed
Angelica geniculata
CKB, 1915.

climbing-broom
Carmichaelia gracilis
CNZ, 1919.

climbing club-moss
Lycopodium volubile
CTP, 1908.
THW, 1909.

climbing convolvulus
Calystegia tuguriorum
CNZ, 1919.

climbing-convolvulus
C. tuguriorum
CNZ, 1910.
CNZ, 1919.

climbing daisy
Senecio sciadophilus
DCO, 1900.

climbing fern
Lygodium articulatum
DDD, 1917.

climbing-fern
Lygodium articulatum
DMs., 1921.

climbing flowering fern
Lygodium articulatum
DDD (2), 1925.

climbing-gourd
Sicyos australis
CNZ, 1919.

climbing-groundsel
Senecis sciadophilus
CKB, 1915.

climbing hard fern
Blechnum filiforme
POO, 1882.

climbing hard-fern
B. filiforme
CWK, 1908.
CNZ, 1910.
CNZ, 1919.

climbing lignum
Muehlenbeckia adpressa.
VN, 1920.

climbing lily
Rhipogonum scandens
DCO, 1900.

climbing New Zealand broom
Carmichaelia gracilis
CNZ, 1919.

climbing New Zealand spinach
Tertagonia trigyna
CSI, 1909.
CDA, 1911.

climbing polypody
Polypodium diversifolium
CTP, 1908.

climbing-polypody
P. diversifolium
CNZ, 1910.
CNZ, 1919.

climbing rata
Metrosideros scandens
LB, 1906.

climbing red rata
Metrosideros florida
OTR, 1916.

climbing rhipogonum
Rhipogonum scandens
LB, 1906.

climbing shield fern
Polystichum adiantiforme
POO, 1882.

climbing sundew
Drosera auriculata
CWK, 1908.
CNZ, 1910.
CDA, 1911.

climbing umbrella-fern
Gleichenia circinata
CNZ, 1910.
G. dicarpa
CNZ, 1910.

climbing white rata
Metrosideros scandens
OTR, 1916.

clinging climbing rata
M. scandens
CNZ, 1919.

clinker-beech
Nothofagus truncata
Ver. (C).

clinker birch
?*Nothofagus Menziesii*
Ver. (A).

close-fitting mühlenbeckia
Muehlenbeckia adpressa
LB, 1906.

club-leaved phyllachne
Phyllachne clavigera
CSI, 1909.

club-moss.
Lycopodium
TFF, 1882.
Lycopodium ramulosum
CNZ, 1910.

club rush
Scirpus maritimus
Trans. 1, 1869.

coastal coprosma
Coprosma retusa
CKI, 1907.

coastal daisy-tree
Olearia Solandri
CKI, 1907.

coastal gentian
Gentiana saxosa
CSI, 1909.
CDA, 1911.

coastal hard-fern
Blechnum durum
CNZ, 1910.

coastal jointed rush
Leptocarpus simplex
CNZ, 1919.

coastal sow-thistle
Sonchus littoralis
CSI, 1909.

coastal sowthistle
S. littoralis
CDA, 1911.

coastal veronica
Veronica elliptica
CSI, 1909.

coastal forget-me-not
Myosotis albida
CSI, 1909.

coast groundsel
Senecio lautus
CKI, 1907.
CKB, 1915.

coast-groundsel
S. lautus
CSI, 1909.

coast milk-tree
Paratrophis Banksi
NZJS, 1925.

coccos
See sweet potato

coffee-bush
Coprosma sp.
DRA, 1872.

coffee tree
Coprosma lucida
NC, 1912.

cohou-cohou
Pittosporum obcordatum
RCP, 1846.
HHN, 1867.

Colenso's bristle fern
Trichomanes Colensoi
POO, 1882.

Colenso's copromsa
Coprosma Colensoi
CTP, 1908.

Colenso's daisy-tree
Olearia Colensoi
CSI, 1909.

Colenso's filmy fern
Hymenophyllum villosum
POO, 1882.

Colenso's fuchsia
Fuchsia Colensoi
LB, 1906.

Colenso's nothopanax
Nothopanax Colensoi
LB, 1906.

Colenso's ourisia
Ourisia Colensoi
CTP, 1908.

Colenso's mistletoe
Loranthus Colensoi
LB, 1906.

Colenso's phyllachne
Phyllachne Colensoi
CSI, 1909.

Colenso's pittosporum
Pittosporum Colensoi
CTP, 1908.

Colenso's poa
Poa Colensoi
CIG, 1880.

Colenso's Spaniard
Aciphylla Colensoi
LB, 1906.

Colenso's spleenwort
Asplenium Colensoi
POO, 1882.

Colenso's wineberry
Aristotelia Colensoi
CSI, 1909.

common alpine ligusticum
Anistome aromatica
CTP, 1908.

common adder's tongue
Ophioglossum vulgatum
LFN, 1875.
POO, 1882.

common alpine donatia
Donatia novae-zelandiae
CNZ, 1919.

common anisotome
Anisotome aromatica
CNZ, 1919.

common astelia
Astelia nervosa
CNZ, 1919.

common avens
Geum urbanum
FAA, 1889.

common bladder-wort
Utricularia monanthos
CTP, 1908.

common boss fern
Dryopteris decomposita
POO, 1882.

common bracken
Pteridium esculentum
POO, 1882.
FO, 1886.
CWK, 1908.
CDA, 1911.
CKB, 1915.

common burr
Acaena Sanguisorbae
CKI, 1907.

common carpha
Carpha alpina
CNZ, 1919.

common celmisia
Celmisia longifolia
CTP, 1908.
CKB, 1915.
CNZ, 1919.

common climbing polypody
Polypodium diversifolium
POO, 1882.

common climbing-polypody
P. diversifolium
CNZ, 1919.

common climbing-rata
Metrosideros hypericifolia
CNZ, 1919.

common club-rush
Scirpus nodosus
CNZ, 1919.

common convolvulus
Convolvulus erubescens
CNZ, 1919.

common coprosma
Coprosma propinqua
CKI, 1907.
CSI, 1909
CKB, 1915.
CNZ, 1919.

common cotton-plant
Celmisia spectabilis
CNZ, 1919.

common crantzia
Crantiza lineata
CSI, 1909.
CDA, 1911.

common cudweed
Guaphalium luteo-album
CNZ, 1919.

common davallia
Davallia novae zelandiae
POO, 1882.

common dendrobe
Dendrobium Cunninghamii
CSI, 1909.
CNZ, 1919.

common dichondra
Dichondra repens
CNZ, 1919.

common donatia
Donatia novae-zelandiae
CNZ, 1919.

common drapetes
Drapetes Diffenbachii
CSI, 1909.

common dwarf broom
Carmichaelia nana
CNZ, 1919.

common English bracken
Pteridium esculentum
LFN, 1875.

common fern
Pteridium esculentum
CSJ, 1846.
NZJ, 1848.
HNZ, 1857.
POO, 1882.
CMN, 1906.
EM, 1911.

common field poa
Poa anceps
NZJS, 1923.
Poa anceps var. *foliosa*
CIG, 1880.

common fireweed
Erechtites penanthoides
CKI, 1907.
CSI, 1909.
CKB, 1915.

common forstera
Forstera sedifolia
CSI, 1909.

common hard fern
Blechnum discolor
POO, 1882.
CTP, 1908.
CSI, 1909.
CKB, 1915.
CNZ, 1919.

common hooded orchid
Pterostylis Banksii
CKI, 1907.
CTP, 1908.
CKB, 1915.

common ivy-tree
Nothopanax arboreum
CTP, 1908.

common karamu
Coprosma robusta
CNZ, 1919.

common koromiko
Veronica salicifolia
CNZ, 1919.

common kowhai
Sophora microphylla
CNZ, 1919.

common libertia
Libertia ixioides
CSI, 1909.
CDA, 1911.
CKB, 1915.

common maidenhair
Adiantum affine
POO, 1882.
CWK, 1908.
THW, 1909.
CNZ, 1919.

common mistletoe
Loranthus micranthus
CNZ, 1919.

common mountain-gentian
Gentiana bellidifolia
CTP, 1908.
CNZ, 1919.

common mountain-groundsel
Senecis bellidioides
CSI, 1909.
CNZ, 1919.

common mountain shrubby groundsel
Senecis elaeagnifolius
CSI, 1909.

common mountain tree-daisy
Olearia Colensoi
CNZ, 1919.

common needle-leaved heath
Dracophyllum Urvilleanum
CWK, 1908.

common New Zealand broom
Carmichaelia subulata
CNZ, 1919.

common New Zealand buttercup
Ranunculus hirtus
CKI, 1907.
CTP, 1908.
CSI, 1909.
THW, 1909.
CKB, 1915.

common New Zealand epacris
Epacris pauciflora
CWK, 1908.

common New Zealand gentian
Gentiana bellidifolia
THW, 1909.
G. Griesbachii
CSI, 1909.

common New Zealand groundsel
Senecio bellidioides
CNZ, 1919.

common New Zealand lobelia
Lobelia anceps
CKI, 1907.
CWK, 1908.

common New Zealand mistletoe
Loranthus micranthus
CSI, 1909.
CKB, 1915.
CNZ, 1919.

common New Zealand plantain
Plantago Raoullii
CKI, 1907.

common New Zealand pondweed
Potamogeton Cheesemanii
CKI, 1907.

common New Zealand violet
Viola Cunninghamii
CTP, 1908.
THW, 1909.
CKB, 1915.

common oat-grass
Danthonia semiannularis
CWK, 1908.
CSI, 1909.
CDA, 1911.
CKB, 1915.
CNZ, 1919.
NZJS, 1923.

common oreobolus
Oreobolus pectinatus
CSI, 1909.
CNZ, 1919.

common phyllachne
Phyllachne Colensoi
CNZ, 1919.

common pimelea
Pimelea laevigata
CTP, 1908.
CDA, 1911.

common polypody
Polypodium diversifolium
CKB, 1915.

common pond-weed
Potamogeton Cheesemanii
CNZ, 1919.

common pratia
Pratia angulata
CTP, 1908.

common raoulia
Raoulia australis
CNZ, 1919.

common rush
Juncus polyanthemos
Trans. 2, 1870.
CKI, 1907.
CTP, 1908.
CKB, 1915.

common scleranth
Scleranthus biflorus
CNZ, 1919.

common spider-orchid
Corysanthes triloba
CSI, 1909.
CKB, 1915.

common solanum
Solanum aviculare
CWK, 1908.

common spleenwort
Asplenium bulbiferum
POO, 1882.
CSI, 1909.
THW, 1909.
CKB, 1915.

common thelymitra
Thelymitra longifolia
CWK, 1908.
CDA, 1911.

common tussock-grass
Poa caespitosa
CTP, 1908.
CSI, 1909.
CDA, 1911.

common tute
Coriaria sarmentosa
CSI, 1909.
CDA, 1911.

common twig-rush
Cladium teretifolium
CNZ, 1919.

common vegetable-sheep
Raoulia eximia
CNZ, 1919.

common veronica
Veronica salicifolia
CKI, 1907.
CWK, 1908.

common water-milfoil
Myriophyllum elatinoides
CKI, 1907.
CSI, 1909.
CNZ, 1919.

common whipcord koromiko
Veronica lycopodioides
CNZ, 1919.

convolvulus
Calystegia sepium
NZCJ, 1886.

Cook's scurvy-grass
Lepidium oleraceum var. *acutidentatum*
CVN, 1777.
Trans. 23, 1891.
KSF, 1899.
CMN, 1906,
CSI, 1909.
CNZ, 1910.
Trans. 44, 1912.
NZJS, 1925.

Cook Strait koromiko
Veronica salicifolia var. *Atkinsonii*
CNZ, 1919.

coral-broom
Corallospartium crassicaule
KSF, 1899.
CNZ, 1919.
CCN, 1924.
C. crassicaule var. *racemosa*
DCO, 1900.
CMN, 1906.

coral-shrub
Helichrysum coralloides
CNZ, 1919.
CCN, 1924.

cork tree
Entelea arborescens
CTN, 1830.
FAA, 1889.

cornel-leaved pittosporum
Pittosporum cornifolium
LB, 1906.

cork-wood
Entelea arborescens
KFF, 1889.
MNZ, 1905.

corkwood
Entelea arborescens
KSF, 1899.

coronopus-leaved cotula
Cotula coronopifolia
LB, 1906.

corymbose pennantia
Pennantia corymbosa
LB, 1906

cotoneaster-like corokia
Corokia cotoneaster
LB, 1906.

cotton grass
Celmisia longifolia
Trans. 5, 1873.

cotton-grass
C. longifolia
Trans. 5, 1873.

cotton plant
Astelia
HHN, 1867.
Celmisia coriacea
TCS, 1851.
Trans. 1, 1869.
NZCJ, 1885.
CMN, 1906.
C. laricifolia
NZCJ, 1885.
**C. spectabilis*
NZCJ, 1885.
CTP, 1908.

cotton-plant
Celmisia spectabilis
THW, 1909.
CNZ, 1919.

cotton wood
Pomaderris phylicaefolia
HMB, 1898.

cottonwood
Cassinia leptophylla
CMN, 1906.
LB, 1906.
CKI, 1907.
CNZ, 1910.
CNZ, 1919.

coudy
Agathis australis
NZJ, 1846.

cowage
Bidens pilosa
HHN, 1867.

cowdy
Agathis australis
CJT, 1823.

cowleaf
Melicytus ramiflorus
Trans. 3, 1871.
POO, 1882.
CDA, 1911.

cowri
Agathis australis
PRNZ, 1838.

cowrie
A. australis.
NNV, 1817.
PRNZ, 1838.

†cowrie-pine
A. australis
KFF, 1889.

cowry
A. australis
CJT, 1823.

cow-tree
Melicytus ramiflorus
Trans. 44, 1912.

‡cracker
Corynocarpus laevigata
MTN, 1834.

crane's bill
Geranium
FAA, 1889.

crane's-bill
Geranium
TNC, 1856.

cranesbill
Geranium
HHN, 1867.

crape fern
Leptopteris superba
FFN, 1890.
CTP, 1908.

*"This is the cotton plant of the shepherds; they peel off the cotton and use it to light their pipes, with the aid of a lens."—F. N. Adams in NZCJ, vol. 9, 1885, p. 141.

†"Cowrie-pine and Kowdie-pine were the names by which the kauri was first introduced to Britain."—KFF, p. 143.

‡"Their caraceer or cracker as we call it."—MTN, p. 45.

crape-fern
L. superba
TFF, 1882.
THW, 1909.
CNZ, 1910.
CNZ, 1919.
CCN, 1924.

creek fern
Blechnum fluviatile
POO, 1882.
CWK, 1908.

creek-fern
B. fluviatile
CTP, 1908.
CKB, 1915.
CNZ, 1919.

creeper-fern
Cyclophorus serpens
DRA, 1872.

creeping club-moss
Lycopodium cernuum (?)
L. scariosum
CTP, 1908.
THW, 1909.

creeping dichondra
Dichondra repens
LB, 1906.

creeping fuchsia
Fuchsia procumbens
TNN, 1909.

creeping gunnera
Gunnera prorepens
CTP, 1908.

creeping-gunnera
G. prorepens
CSI, 1909.

creeping-lawyer
Rubus parvus
CNZ, 1919.

creeping maiden hair
Adiantum aethiopicum
DDD (2), 1925.

creeping marsh willow-herb
Epilobium insulare
CSI, 1909.

creeping matipo
Suttonia nummularia
CTP, 1908.

creeping-matipo
S. nummularia
CSI, 1909

creeping mountain-foxglove
Ourisia caespitosa
CNZ, 1919

creeping New Zealand burr-reed
Sparganium subglobosum
CNZ, 1919

creeping New Zealand calceolaria
Jovellana repens
CNZ, 1919

creeping ourisia
Ourisia caespitosa
CTP, 1908.

creeping pimelea
Pimelea laevigata
CWK, 1908.

creeping pohuehue
Muehlenbeckia axilaris
CNZ, 1919

creeping pratia
Pratia angulata
CSI, 1909

creeping-pratia
Pratia angulata
CDA, 1911.

creeping-sedge
Carex pumila
CNZ, 1910.

creeping selliera
Selliera radicans
CSI, 1909
CNZ, 1919.

creeping-selliera
S. radicans
CDA, 1911.

creeping totara
Podocarpus nivalis
THW, 1909.

creeping tree fern
Alsophila Colensoi
DDD (2), 1925.

creeping willow-herb
Epilobium nummularifolium
CKI, 1907.
CWK, 1908.
CKB, 1915.

creeping yellow wood-sorrel
Oxalis corniculata
CKI, 1907.

crested hair grass
Koeleria Kurtzii
CIG, 1880.

crimson clianthus
Clianthus puniceus
B, 1837.

crimson climbing-rata
Metrosideros diffusa
CNZ, 1919.

crimson-flowered manuka
Leptospermum Nichollsii
DDD, 1917.

crimson manuka
L. Nichollsii
OTR, 1916.

crisped filmy fern
Hymenophyllum australe
POO, 1882.
CWK, 1908.

crowfoot
Ranunculus
FAA, 1889.

crown-fern
Blechnum discolor
DMs., 1921.

Cunningham's dendrobium
Dendrobium Cunninghamii
LB, 1906.

Cunningham's gastrodia
Gastrodia Cunninghamii
LB, 1906.

Cunningham's maiden hair fern
Adiantum affine
LFN, 1875.

Cunningham's polypody
Polypodium dictyopteris
POO, 1882.
CWK, 1908.

Cunningham's sandalwood
Fusanus Cunninghamii
LB, 1906.

Cunningham's snow-grass
Danthonia Cunninghamii
NZJS, 1923.

Cunningham's tree-fern
Cyathea Cunninghamii
POO, 1882.

Cunningham's violet
Viola Cunninghamii
LB, 1906.

curled arthropodium
Arthropodium cirratum
LB, 1906.

curved tangle-fern
Gleichenia circinata
DMs., 1921.

cushion-forming heath
Dracophyllum politum
CSI, 1909.

cushion-like haastia
Haastia pulvinaris
LB, 1906.

cushion plant
Scleranthus biflorus
Trans. 47, 1915.

*cushion-plant
Donatia novae-zealandiae
CNZ, 1910.

cut-leaved alpine buttercup
Ranunculus Buchanani
CNZ, 1919

cut-leaved bracken
Histiopteris incisa
POO, 1882.
CTP, 1908.

cut-leaved geranium
Geranium dissectum var. *australe*
LB, 1906.

cut-leaved marsh pennywort
Hydrocotyle dissecta
CWK, 1908.

cut-leaved nightshade
Solanum aviculare
BGN, 1860.

cutting grass
Arundo conspicua
TIM, 1855.
Gahnia Gaudichaudii
Gahnia lacera
HHN, 1867.
Trans. 2, 1870.
Gahnia xanthocarpa
Trans. 2, 1870.

cutting grass
Hierochloe redolens
NZCJ, 1879.

cutting-grass
Carex ternaria
CKI, 1907.
CTP, 1908.
CSI, 1909
CDA, 1911.
CKB, 1915.
Gahnia pauciflora
THW, 1909.
G. xanthocarpa
THW, 1909.
Mariscus ustulatus
Trans. 20, 1888.

cutting toe-toe
Mariscus ustulatus
Trans. 4, 1872.

cyperus-sedge
Carex pseudo-cyperus var. *fascicularis*
CNZ, 1919

cypress
Libocedrus Doniana
HHN, 1867.

cypress-koromiko
Veronica cupressoides
CNZ, 1919

dacrydium-like podocarpus
Podocarpus dacrydioides
LB, 1906.

daisy
Brachycome Sinclairii
Trans. 2, 1870.

daisy shrub
Senecis Kirkii
THW, 1909.

daisy tree
Olearia
MLN, 1890.

daisy-tree
Olearia
HHN, 1867.
DCO, 1900.
O. angustifolia
MNZ, 1905.

daisy-tree.
O. arborescens
MNZ, 1905.
THW, 1909.
O. furfuracea
CNZ, 1910.

deciduous tree-groundsel
Senecis Hectori
CNZ, 1919

dense-flowered cuscuta
Cuscuta densiflora
LB, 1906.

dense-flowered poa
Poa anceps var. *densiflora.*
CIG, 1880.

desert-danthonia
Danthonia Buchanani
CNZ, 1919

desert oat-grass
D. semiannularis
CTP, 1908.
THW, 1909.

devil's purse
Clathrus cibarius
NZJS, 1922.

dichondra
Dichondra repens
CNZ, 1919

dichondra-leaved nertera
Nertera dichondraefolia
LB, 1906.

dirty fern
Dryopteris velutena
FFN, 1890.

ditch millet
Paspalum scrobitulatum
CIG, 1880.

divaricate suttonia
Suttonia divaricata
LB, 1906.

divaricate tree-daisy
Olearia divaricata
CNZ, 1919

* Distinction between cushion-plants and mat-plants described by C. E. Foweraker; Trans. 49, pp. 2, 3, 1917.

The following are dealt with:

(*a*) cushion-plants:
1. *Raoulia lutescens*
2. „ *Haastii*
3. *Scleranthus biflorus*

(*b*) mat-plants
4. *Raoulia tenuicaulis*
5. „ *australis*
6. „ *glabra*
7. „ *subsericea*
8. „ *Monroi*
9. *Acaena microphylla*
10. *Coprosma Petriei*
11. *Muehlenbeckia axillaris*
12. *Pimelea prostrata*

double crape fern
Leptopteris superba
CTP, 1908.

double crape-fern
L. superba
CSI, 1909
THW, 1909.

***double fern**
Blechnum capense
POO, 1882.

double velvet fern
Leptopteris superba
POO, 1882.

doubtful lobelia
Lobelia anceps
LB, 1906.

downy ironheart
Metrosideros tomentosa
DRA, 1872.

downy rata
M. tomentosa
LB, 1906.

†dragon tree
Cordyline australis
NZJ, 1841.

dragon-tree
C. australis
NNV, 1817.
TNC, 1856.

drooping bristle fern
Trichomanes humile
POO, 1882.
CWK, 1908.

drooping club-rush
Scirpus filiformis
CKI, 1907.

drooping filmy fern
Hymenophyllum demissum
POO, 1882.
CWK, 1908.

drooping fescue
Festuca multinodis
CKB, 1915.

drooping pine
Dacrydium cupressinum
Ver. (WB).

drooping spleenwort
Asplenium adiantoides
CWK, 1908.
CSI, 1909

drooping spleenwort
A. falcatum
THW, 1909.
A. flabellifolium
LFN, 1875.
POO, 1882.
A. flaccidium
LFN, 1875.
CTP, 1908.

drooping-spleenwort
A. flabellifolium
CKB, 1915.
A. flaccidum
CNZ, 1900.
CKB, 1915.
CNZ, 1919
DMs., 1921.

duck weed
Lemna minor
Trans. 1, 1869.

duck-weed
L. minor
TIC, 1906.

duckweed
L. minor
HHN, 1867.
CMN, 1906.
CKI, 1907.
CWK, 1908.
DFC, 1916.

dune coprosma
Coprosma acerosa
CSI, 1909.

dune-coprosma
C. acerosa
CDA, 1911.

dune sedge
Carex pumila
CSI, 1909

dune-sedge
C. pumila
CDA, 1911.

D'Urville's peperomia
Peperomia Urvilleana
LB, 1906.

D'Urville's rapanea
Rapanea Urvillei
LB, 1906.

dusky beech
Nothofagus fusca
LB, 1906.

dwarf astelia
Astelia linearis
CSI, 1909

dwarf bearded heath
Leucopogon Fraseri
CWK, 1908.

dwarf bedstraw
Asperula perpusilla
CNZ, 1919

dwarf cabbage palm
Cordyline terminalis
DDD, 1917.

dwarf cabbage tree
Cordyline pumilio
DDD (2), 1925.

dwarf cabbage-tree
Cordyline pumilio
CNZ, 1910.
CCN, 1924.

dwarf carmichaelia
Carmichaelia nana
LB, 1906.

dwarf comb fern
Schizaea australis
POO, 1882.

dwarf false musk
Mazus pumilio
CNZ, 1919

dwarf heath
Leucopogon Fraseri
CKI, 1907.
CTP, 1908.
CNZ, 1910.

dwarf kowhai
Sophora prostrata
CKB, 1915.

dwarf mazus
Mazus pumilio
LB, 1906.

dwarf mountain bent grass
Agrostis Muelleri
CIG, 1880.

dwarf nettle
?Urtica incisa
WDJ, 1850.

dwarf New Zealand nightshade
Solanum nigrum
MVC, 1864.

dwarf-pine
Dacrydium taxifolium
CNZ, 1910.

dwarf poa
Poa pygmaea
CIG, 1880.

dwarf polypody
Polypodium pumilium
CSI, 1909

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*This was *Lomaria duplicata* of Potts, who thence named it the double fern: the name was changed first to *L. capensis*, then to *Blechnum capense*.

†When this name was given the tree was *Dracœna australis*

dwarf ring grass
Danthonia semiannularis
NZCJ, 1879.

dwarf tainui
Pomaderris elliptica
DDD, 1917.

Dyer's eye-bright
Euphrasia Dyeri
CSI, 1909

ear-shaped drosera
Drosera auriculata
LB, 1906.

East Cape groundsel
Senecis Banksii
CNZ, 1919

eddas
See Sweet potato

edelweiss
Leucogenes grandiceps
NZCJ, 1885.
DCO, 1900.

Edgerley's nothopanax
Nothopanax Edgerleyi
LB, 1906.

Edgerley's panax
Nothopanax Edgerleyi
CWK, 1908.
CSI, 1909

eel-grass
Zostera nana
CSI, 1909

Egmont buttercup
Ranunculus nivicola
CTP, 1908.
CNZ, 1919

Egmont fern
Polystichum cystostegium
FFN, 1890.

elatine-like glossostigma
Glossostigma elatinoides
LB, 1906.

elatine-like myriophyllum
Myriophyllum elatinoides
LB, 1906.

elder-berry
Coriaria sarmentosa
NNV, 1817.
PNZ, 1838.

elegant senecio
Senecio lautus
LB, 1906.

elliptical-leaved pomaderris
Pomaderris elliptica
LB, 1906.

embossed myrtle
Myrtus bullata
LB, 1906.

English maidenhair
Adiantum aethiopicum
POO, 1882.

entire-leaved beech
Nothofagus Solanderi
RDT, 1875.
Trans. 17, 1885.
KFF, 1889.
CTP, 1908.
CNZ, 1910.

entire-leaved clematis
Clematis indivisa
LB, 1906.

Enys's native broom
Carmichaelia Enysii
CTP, 1908.

epacris-like veronica
Veronica epacridea
LB, 1906.

equal-glumed millet
Isachne australis
CIG, 1880.

erect halorrhagis
Halorrhagis erecta
LB, 1906.

erect plumed tussac grass
Arundo fulvida
CIG, 1880.

erect-plumed tussock-grass
A. conspicua
CSI, 1909

erect snowberry
Gaultheria antipoda
CWK, 1908.

eryngo
Eryngium vesiculosum
Trans. 1, 1869.

*esparto grass
?
MSO, 1878.

eugenia-like pittosporum
Pittosporum eugenioides
LB, 1906.

everlasting
Gnaphalium
HHN, 1867.

evil-smelling hupiro
Coprosma foetidissima.
CNZ, 1919

evil-smelling karamu
Coprosma foetidissima
CNZ, 1919

extraordinary raoulia
Raoulia eximia
LB, 1906.

eye-bright
Euphrasia cuneata
Trans. 28, 1896.
Euphrasia zealandica
TNN, 1909.

eyebright
Euphrasia Cockayniana
CNZ, 1910.
Euphrasia Monroi
NZCJ, 1885.
HNF, 1888.
CNZ, 1910.

eyebrigtht (evident misspelling)
E. Monroi
HRN, 1889.

fairy's closet
Clathrus cibarius
Ver.

false edelweiss
Helichrysum bellidioides
CNZ, 1919.
CCN, 1924.

false mountain-holly
Olearia macrodonta
CNZ, 1919

false native pepper
Wintera (= Drimys) colorata
DCO, 1900.

false New Zealand holly
Olearia macrodonta
CNZ, 1919

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*Botanical name not given: the plant was gathered in the Mataura district, and tried for paper-making.—MSO, pp. 29-30.

false snow-grass
Schoenus pauciflorus
CTP, 1908.
CSI, 1909
CNZ, 1919.

fan fern
Gleichenia flabellata.
FFN, 1890.

fan-fern
G. flabellata
FFN, 1890.

fan-leaved fern
G. flabellata
POO, 1882.

fan-leaved filmy fern
Hymenophyllum flabellatum
POO, 1882.
CTP, 1908.

fan-like umbrella fern
Gleichenia flabellata
CWK, 1908.

fan umbrella fern
Gleichenia flabellata
DDD (2), 1925.

feather-crowned polypody
Dryopteris pennigera
POO, 1882.

feather fern
D. pennigera
CWK, 1908.

feather-fern
D. pennigera
CKB, 1915

female pohutukawa
Metrosideros robusta
FAA, 1889.

fern
Pteridium esculentum
CV, 1769.
SAN, 1807.
Trans. 44, 1912.
FO, 1886.
DFN, 1921.

fern-flower
Drosera binata
GST, 1921.

fern-palm
Rhopalostylis sapida
FO, 1886.

*fern-strangler
Dracophyllum scoparium
NZCJ, 1888.

fescue-tussock
Festuca novae-zealandiaè
CNZ, 1919.

†few-flowered oat grass
Triodia exigua
CIG, 1880.

few-flowered epacris
Epacris pauciflora
LB, 1906.

few-leaved bitter-cress
Cardamine heterophylla var. *uniflora*
CSI, 1909

fibrous-stemmed tree-fern
Dicksonia fibrosa
THW, 1909.

fibrous tree-fern
D. fibrosa
LHW, 1909.

Field's fern
Hymenophyllum rufescens
POO, 1882.

field sundew
Drosera auriculata
FAA, 1889.

fierce nettle
Urtica ferox
LB, 1906.

fig marigold
Mesembryanthemum
TNN, 1909.

fig-marigold
M. australe
TNN, 1909.

fig-marygold
M. australe
Trans. 1, 1869.

filmy fern
Hymenophyllum Tunbridgense
FFN, 1890.

filmy-fern
Hymenophyllum
TFF, 1882.

filmy todea
Leptopteris hymenophylloides
POO, 1882.

‡fir
? Podocarpus totara
SAN, 1807.

fir club-moss
Lycopodium Selago
CTP, 1908.

fishbone fern
Blechnum discolor
VN, 1920.

fish-bone tree
Pseudopanax crassifolium
BGN, 1860.

fish-guts plant
Chenopodium detestans
Trans. 10, 1878.

five-finger
Nothopanax arboreum
DDD, 1917.
Ver.

five-finger
Schefflera digitata
MNZ, 1905.
EM, 1911

five-fingered Jack
Nothopanax arboreum
DCO, 1900.

five fingers
Schefflera digitata
Ver. (WB).

flag
Arundo conspicua
NNV, 1817.
ASC, 1853.
Phormium tenax
CV, 1769-70.
Typha angustifolia
MTN, 1834.

flaggy grass
Typha angustifolia
NNV, 1817.

flat-leaved rush
Juncus planifolius
CSI, 1909

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*Potts gives the reason for the name,—strangling of tree ferns by slow constriction.--NZCJ, vol. 12, 1888, pp. 197-98.

†*Danthonia pauciflora* in CIG, whence the name.

‡"The timber of which we have the most knowledge at present is the fir, which grows here to an amazing height, and of such dimensions as to admit of being formed into a canoe capable of containing thirty persons, or in other words five and six feet diameter." SAN, p. 8. Savage was only at Bay of Islands, and saw no forest.

flat-leaved sedge
Carex dissita
CSI, 1909.

flax
Linum monogynum
Trans. 1, 1869.
DCO, 1900.
Phormium tenax
CVS, 1773.
SAN, 1807.
NNV, 1817.
PNZ, 1838.
PRNZ, 1838.

flax lily
P. tenax
LCN, 1868.

flax-lily
P. tenax
MSE, 1888
DCO, 1900.
LB, 1906.

fleshy-leaved buttercup
Ranunculus Haasti
DCO, 1900.

fleshy-leaved lobelia
Lobelia Roughii
CNZ, 1910.

fleshy-leaved sow-thistle
Sonchus littoralis
CDA, 1911.

fleshy ligusticum
Anisotome carnosulum
LB, 1906.

floating duckweed
Lemna minor
CNZ, 1919.

floating water-fern
Azolla rubra
CNZ, 1910.
CNZ, 1919.

florid rata
Metrosideros florida
FAA, 1889.

flowering fern
Lygodium articulatum
DDD, 1917.

flowery rata
Metrosideros florida
LB, 1906.

fly-catcher
Drosera sp.
Trans. 13, 1881.
Drosera binata
KSF, 1899.

foetid coprosma
Coprosma foetidissima
LB, 1906.

forest daisy-tree
Olearia Cunnihghamii
CKI, 1907.
CWK, 1908.

forest-groundsel
Senecis Kirkii
CWK, 1908.

*forest houri
Cyathea etc.
HNZ, 1857.

forest libertia
Libertia pulchella
CTP, 1908.

forest-loving weinmannia
Weinmannia sylvicola
LB, 1906.

forest-nettle
Urtica incisa
CSI, 1909.
CKB, 1915

forest rice-grass
Microlaena avenacea
CKB, 1915
NZJS, 1923.

forest snowberry
Enargea parviflora
CSI, 1909.
CNZ, 1919.

forest tree-groundsel
Senecis Kirkii
CNZ, 1919.

forest willow-herb
Epilobium linnaeoides
CKI, 1907.
CWK, 1908.

forget me not
Myosotis Forsteri
Trans. 2, 1870.

forget-me-not
M. antarctica
Trans. 30, 1898.
M. spathulata
Trans. 30, 1898.

forked comb fern
Schizaea bifida
POO, 1882.

forked sundew
Drosera arcturi
SPR, 1909.

forked umbrella-fern
Gleichenia dichotoma
POO, 1882.

fork-leaved sun-dew
Drosera binata
CSI, 1909.

Forster's daisy-tree
Olearia Forsteri
CKI, 1907.

Forster's forget-me-not
Myosotis Forsteri
CTP, 1908.

Forster's lagenophora
Lagenophora pumila
LB, 1906.

Forster's olearia
Olearia Forsteri
LB, 1906.

four-petalled mistletoe
Loranthus tetrapetalus
LB, 1906.

fragile bladder-fern
Cystopteris novaezelandiae
DMs., 1921.

fragrant earina
Earina autumnalis
CWK, 1908.
E. suaveoleus
LB, 1906.

fragrant-fern
Dryopteris pustulata
DMs., 1921.

fragrant tree-daisy
Olearia fragrantissima
CKB, 1915
CNZ, 1919.

Frazer's fern
Blechnum Fraseri
POO, 1882.

Frazer's leucopogon
Leucopogon Fraseri
LB, 1906.

fringed filmy fern
Hymenophyllum ciliatum
POO, 1882.

fruiting duckweed
Nertera depressa
CWK, 1908.

*We find three varieties of that forest Houri the Fern-tree.—" HNZ, p. 86.

fuchsia
Fuchsia excorticata
TNC, 1856.
KFF, 1888.
JM, 1909.
THW, 1909.
EM, 1911.
HEC, 1915.

fuchsia-barked olearia
Olearia excorticata
MNZ, 1905.

fuchsia-barked totara
Podocarpus Hallii
MNZ, 1905.

Fuchsia tree
Fuchsia excorticata
POO, 1882.

fuchsia-tree
F. excorticata.
HNZ, 1857.
DRA, 1872.

*gadoa
Leptospermum scoparium
RSC, 1844.

gei-gei
Freycinetia Banksii
BWM, 1914.

gentian
Gentiana chathamica
CNZ, 1910.
G. montana
Trans. 1, 1869.

gentian of the rocks
Gentiana saxosa
LB, 1906.

ghoa
ghoai
Sophora Otraptera
LCN„ 1868.

giant astelia
Astelia nervosa
THW, 1909.

giant cutting-sedge
Gahnia xanthocarpa
CWK, 1908.

giant-flowered southern lacebark
Gaya Lyallii
OTR, 1916.

giant forget-me-not
Myosotidium nobile
NZCJ, 1885.
MLN, 1890.
CNZ, 1910.
CNZ, 1919.

giant gahnia
Gahnia xanthocarpa
CNZ, 1919.

giant lycopodium
Lycopodium volubile
DDD, 1917.

giant maiden-hair
Adiantum formosum
DDD, 1917.

giant moss
Dawsonia superba
CNZ, 1919.

giant polypody
Polypodium novae-zelandiae
POO, 1882.
CTP, 1908.

giant rata
? *Metrosideros florida*
HNZ, 1857.

giant rimu
Dacrydium cupressinum
CNZ, 1919.

giant rush
Juncus pallidus
CSI, 1909.

giant spaniard
Aciphylla maxima
CNZ, 1919.

giant white buttercup
Ranunculus Lyallii
DDD, 1917.

gigi
Freycinetia Banksii
BOS, 1900.

glabrous raoulia
Raoulia glabra
CSI, 1909.

glandular ourisia
Ourisia glandulosa
LB, 1906.

glasswort
Salicornia australis
Trans. 1, 1869.

glaucous euphorbia
Euphorbia glauca
LB, 1906.

glory of the west
Leptopteris superba
POO, 1882.

glory pea
Clianthus punicens
B, 1837.
FAA, 1889.

glossy ascarine
Ascarina lucida
CNZ, 1919.

glossy coprosma
Coprosma robusta
CKI, 1907.
CWK, 1908.
CKB, 1915

glossy karamu
Coprosma robusta
CNZ, 1919.

glossy-leaved daisy-tree
Olearia arborescens
CTP, 1908.

glossy-leaved willow-herb
Epilobium glabellum
THW, 1909.

glossy-leaved willowherb
Epilobium glabellum
CTP, 1908.

glossy plantain
Plantago Hamiltonii
CNZ, 1919.

glossy tree-daisy
Olearia arborescens
CNZ, 1919.

gnaio
Myoporum laetum
PLC, 1857.

†gnais
Myoporum laetum
TCS, 1851.

goa
Sophora tetraptera
LCN, 1868.

goai
Sophora tetraptera
LCN, 1868.
CCV, 1872.

* ? an abbreviation and corruption of kahikatoa;—"the kahikatoa, also called gadoa, or manuko, a philadelphus with a very hard and brown wood..." Dieffenbach's report, RSC, p. 611.

† This appeared a misprint for gnaio, a transposition of ngaio, until the following was met with: "you heard incessant crackling of 'gnais'; a nut like an almond."—"First voyage of the new 'Southern Cross'," 1874, p. 18. From *Melanesian Mission Reports*, 1873-1881.

Godley's buttercup
Ranunculus Godleyanus
CCO, 1900.

gohi
Sophora tetraptera
BSL, 1870.

goi
Sophora microphylla
TNC, 1856.
S. tetraptera
MSO, 1878.

golden akeake
Olearia Forsteri
MNZ, 1905.
OTR, 1916.
DDD, 1917.

golden-akeake
Olearia Forsteri
MNZ, 1905.

golden cottonwood
Cassinia fulvida
CNZ, 1919.

golden pine
Dacrydium Colensoi
GCN, 1888.

golden punga
Dicksonia fibrosa
OTR, 1916.

golden rata
Metrosideros florida var. *aurata*
JM, 1909.

golden tree fern
Dicksonia fibrosa
OTR, 1916.
DDD, 1917.
DDD (2), 1925.
Alsophila Colensoi
DFN, 1921.

golden tree-fern
Alsophila Colensoi
DMS, 1921.

golden-yellow Mount Egmont buttercup
Ranunculus nivicola
CNZ, 1919.

gourd
?Calystegia
CV, 1769
Lagenaria vulgaris
Trans. 33, 1901.
Trans. 35, 1903.
CMN, 1906.

gowai
Sophora tetraptera
BAF, 1863.
PWW, 1889.

gowhai
Sophora tetraptera
Trans. 1, 1869.

graceful blue-bell
Wahlenbergia gracilis
LB, 1906.

grassland buttercup
Ranunculus multiscapus
CNZ, 1919.

grassland-buttercup
R. multiscapus
CNZ, 1919.

grassland-daisy
Brachycome Sinclairii
CNZ, 1919.

grass-like hooded orchid
Pterostylis graminea
CTP, 1908.

grass-lily
Herpolirion novae-zelandiae
CNZ, 1919.

grass tree
Cordyline australis
HNP, 1867.
Dracophyllum latifolium
DDD, 1917.
D. longifolium
Trans. 1, 1869.
MLN, 1890.
Pseudopanax crassifolium
Trans. 9, 1877.

grass-tree
Dracophyllum longifolium
NZCJ, 1856.
KFF, 1889.
CMN, 1906.
CSI, 1909.
THW, 1909.
D. Urvilleanum
EM, 1911.
Pseudopanax crassifolium
KFF, 1889.
CSI, 1909.
Ver. (WB).

grass-wrack
Zostera nana
CSI, 1909.

great bulrush
Scirpus lacustris
CNZ, 1910.

great sedge
Carex trifida
CSI, 1909.

great sow-thistle
Sonchus grandifolius
CNZ, 1910.
CNZ, 1919.

great sowthistle
S. grandifolius
CNZ, 1919.

great spike-rush
Elaeocharis sphacelata
CNZ, 1919.

great white groundsel
Senecio scorzonerioides
CSI, 1909.

greater-spaniard
**Aciphylla Colensoi* var. *maxima*
KSF, 1899.

green biddy-bid
Acaena Sanguisorbae
CKB, 1915

green cushion-celmisia
Celmisia bellidioides
CNZ, 1919.

green fern
Histiopteris incisa
Ver. (A).

green lindsaya
Lindsaya viridis
POO, 1882.
DMs., 1921.

green mistletoe
Tupeia antarctica
THW, 1909.

green raoulia
Raoulia Haastii
CNZ, 1919.

green tree-fern
Hemitelia Smithii
CNZ, 1919.

green vegetable-sheep
Raoulia rubra
CNZ, 1919.

ground-lily
Herpolirion novae-zelandiae
DCO, 1900.

ground nettle
Urtica incisa
HMB, 1898.

*Name not now recognised; merged in *A. maxima*.

ground tutu
Coriaria angustissima
TNN, 1909.
C. thymifolia
FAA, 1889.

grove fern
Alsophila Colensoi
NZCJ, 1885.

gully fern
Cyathea Cunninghamii.
DFN, 1921.

gully-fern
Cyathea Cunninghamii
DMs., 1921.

gum tree
Nothopanax Colensoi
Trans. 1, 1869.

Gunn's twig-rush
Cladium Gunnii
CSI, 1909.

Haast's ranunculus
Ranunculus Haastii
LB, 1906.

Haast's raoulia
Raoulia Haastii
LB, 1906.

hair-like sedge
Carex comans
CSI, 1909.

hairy alpine buttercup
Ranunculus insignis
CNZ, 1919.

hairy bitter-cress
Cardamine heterophylla
CKI, 1907.
CTP, 1908.
THW, 1909.
CKB, 1915.

hairy boss fern
Dryopteris hispida
POO, 1882.

hairy cardamine
Cardamine heterophylla
FAA, 1889.

hairy climbing-rata
Metrosideros Colensoi
CNZ, 1919.

hairy cloak fern
Nothochlaena distans
LFN, 1875.

hairy coprosma
Coprosma ciliata
CSI, 1909.

hairy fern
hairy-fern
Drypteris hispida
FFN, 1890.

hairy maidenhair
Adiantum hispidulum
POO, 1882.

hairy maiden hair fern
A. hispidulum
LFN, 1875.

hairy native daisy
Lagenophora lanata
CWK, 1908.

hairy oat-grass
Danthonia pilosa
CKB, 1915

hairy ourisia
Ourisia sessilifolia
CSI, 1909.

hairy pleurophyllum
Pleurophyllum criniferum
LB, 1906.

hairy polypody
Dryopteris punctata
POO, 1882.
CSI, 1909.
CKB, 1915

hairy-stemmed fern
Dryopteris hispida
CWK, 1908.

Hall's totara
Dacrydium Colensoi
THW, 1909.
D. intermedium
THW, 1909.

handsome dysoxylum
Dysoxylum spectabile
LB, 1906.

handsome pleurophyllum
Pleurophyllum speciosum
LB, 1906.

handsome veronica
Veronica speciosa
LB, 1906.

hanging club-moss
Lycopodium Billardieri
CWK, 1908.
THW, 1909.

hanging-tree spleenwort
Asplenium flaccidum
POO, 1882.

hard fern
Paesia scaberula
Ver. (A).

hard-fern
Blechnum
CNZ, 1919.

hard fescue grass
Festuca novae-zelandiae
CIG, 1880.

hard-leaved tree-daisy
Olearia nummularifolia
CNZ, 1919.

hard oat grass
Danthonia pilosa
CIG, 1880.

hard shield-fern
Polystichum Richardi
CNZ, 1919.

hard short-stemmed poa
Poa anceps var. *breviculmis*
CIG, 1880.

hard todea
Todea barbara
POO, 1882.

hard tree fern
Dicksonia squarrosa
OTR, 1916.
DDD (2), 1925.

hard tussock
Festuca novae-zealandiae
CNZ, 1919.

hard-tussock
Festuca novae-zealandiae
CNZ, 1919.

hardy-stemmed fern
Dryopteris hispida
CKB, 1915

hare bell
Wahlenbergia gracilis
Trans. 1, 1869.

*hartwhan
Rhipogonum scandens
MVC, 1864.

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* "'Hartwhan of the natives; 'Supplejack' of the New Zealand colonist." MVC, p. 54.

hassock-grass
Danthonia australis
CMN, 1906.
CNZ, 1919.
heath
Leptospermum scoparium
ASC, 1853.
Trans. 39, 1907.
L. Fraseri
MK, 1908.
heath haloragis
Halorrhagis incana
CWK, 1908.
heath-like coprosma
Coprosma rugosa
CNZ, 1919.
heath-like manuka
Leptospermum ericoides
LB, 1906.
heath-like pomaderris
Pomaderris phylicaefolia
CNZ, 1919.
heath-like tianui
Pomaderris phylicaefolia
DDD, 1917.
heath-veronica
Veronica diosmaefolia
CWK, 1908.
herb bennet
Geum urbanum
FAA, 1889.
hill cudweed
Gnaphalium collinum
CSI, 1909.
CKB, 1915
hill flax
Phormium Colensoi
GST, 1921.
hill-flax
Phormium Colensoi
CSI, 1909.
hoary mountain-musk
Celmisia intermedia
CNZ, 1919.
hoary mountain-ribbonwood
Gaya ribifolia
CNZ, 1919.
holly-leaved olearia
Olearia ilicifolia
LB, 1906.
holy grass
Hierochloe Fraseri
CIG, 1880.
Hierochloe redolens
CTP, 1908.
THW, 1909.

holy-grass
Hierochloe redolens
CSI, 1909.
NZJS, 1923.
honey-suckle
Knightia excelsa
LB, 1906.
honeysuckle
Aleuosmia macrophylla
KFF, 1889.
knightia excelsa
HNR, 1842.
STT, 1850.
HNP, 1867.
Trans. 9, 1877.
KFF, 1889.
VTN, 1896.
MNZ, 1905.
CMN, 1906.
CWK, 1908.
THW, 1909.
HEC, 1915.
Ver. (WB).
hooded orchid
Pterostylis Banksii
THW, 1909.
hooked sedge
Uncinia
CNZ, 1919.
Hooker's spleenwort
Asplenium Hookerianum
POO, 1882.
CKB, 1915
Hooker's veronica
Veronica Hookeriana
CTP, 1908.
hook-leaved black fern
Pellaea falcata
POO, 1882.
hook-leaved sedge
Carex uncifolia
CSI, 1909.
horned oxalis
Oxalis corniculata
LB, 1906.
horse daisy
Celmisia
MLN, 1890.
horse-shoe fern
Marattia fraxinea
FFN, 1890.
OTR, 1916.
DDD, 1917.
DDD (2), 1925.
horseshoe fern
M. fraxinea
DFN, 1921.

Hottentot fig
Mesembryanthemum edule
KSF, 1899.
CNZ, 1910.
CNZ, 1919.
hot-water fern
Leptopteris superba
BOS, 1900.
hound's tongue
Polypodium Billardieri
DFN, 1921.
hound's-tongue
P. Bill.
DMs., 1921.
humble-fern
Trichomanes humile
DMs., 1921.
hybrid ribbonwood
Plagianthus cymosus
CNZ, 1919.
hypericum-leaved rata
Metrosideros Hypericifolia
LB, 1906.
ice-plant
Mesembryanthemum australe
Trans. 20, 1888.
LB, 1906.
CKI, 1907.
CSI, 1909.
CNZ, 1910.
CNZ, 1919.
CCN, 1924.
Tetragona trigyna
KSF, 1899.
incense cedar
Libocedrus Bidwillii
NZCJ, 1885.
Indian salicornia
Salicornia australis
LB, 1906.
ink-berry
? *Coriaria sarmentosa*
BOS, 1900.
inland pohutukawa
Metrosideros robusta
Trans. 4, 1872.
intermediate dianella
Dianella intermedia
LB, 1906.
Irishman
Discaria toumatou
Ver. (abbreviatum of *wild irishman*)
ironbark
Metrosideros lucida
RDT, 1875.

iron wood
Metrosideros hypericifolia
Trans. 1, 1869.
M. lucida
RDT, 1875.
Vitex lucens
HNZ, 1857.

iron-wood
Metrosideros lucida
Trans. 10, 1878.
HRN, 1889.

ironwood
Metrosideros lucida
HHN, 1867.
PPO, 1868.
Trans. 9, 1877.
MSO, 1878.
FAA, 1889.
KFF, 1889.
MLN, 1890.
CSI, 1909.
Met. robusta
Ver. (WB).
Myrtus bullata
HEC, 1915.
M. obcordata
Ver. (Stony Bay)
Olea apetala
KFF, 1889.

ivy-like bramble
Rubus cissoides
LB, 1906.

ivy tree
Nothopanax Colensoi
CCV, 1872.
MLN, 1890.
Pseudopanax crassifolium
Trans. 2, 1870.

ivy-tree
Nothopanax arboreum
Trans. 12, 1880.
CKI, 1907.
CWK, 1908.
THW, 1909.
CNZ, 1910.
CNZ, 1919.
CCN, 1924.
N. Colensoi
HHN, 1867.
THW, 1909.

ixia-like libertia
Libertia ixioides
LB, 1906.

Japanese cudweed
Gnaphalium japonicum
CKI, 1907.
CWK, 1908.
CKB, 1915

Japanese St. John wort
Hypericum japonicum
CSI, 1909.
CKB, 1915

Java fern
Hymenophyllum australe
POO, 1882.

Jersey fern
Gymnogramme leptophylla
LFN, 1875.
POO, 1882.
CKB, 1915

Jersey-fern
DMs., 1921.

Jewe's ear
Hirneola auricula-Judae
TNN, 1909.

Jew's-ear fungus
Hirneola auricula-Judae.
POO, 1882.

jointed angelica
Angelica geniculata
LB, 1906.

jointed rush
Juncus lampocarpus
CSI, 1909.
Leptocarpus simplex
CNZ, 1919.

jointed twig-rush
Cladium articulatum
CNZ, 1919.

*kaio
Myoporum laetum
ATO, 1897.

kaka beak
Clianthus puniceus
OTR, 1916.
Ver. (WB).

kaka-bill
Clianthus puniceus
CCN, 1924.

karewan [= kareao]
Rhipogonum scandens
RSC, 1844.

karmai [= kamahi]
Weinmannia racemosa
HHN, 1867.
CCV, 1872.
Trans. 9, 1877.

kaudi-tree
Agathis australis
HHN, 1867.

kauri fern
Schizaea dichotoma
POO, 1882.

kauri grass
Astelia trinervia
Trans. 11, 1879.

kauri-grass
A. trinervia
Trans. 4, 1872.
CMN, 1906.
CWK, 1908.
CNZ, 1909.
Trans. 43, 1911.
CNZ, 1919.

†kauri pine
Agathis australis
BRP, 1845.
Trans. 1, 1869.
HNF, 1888.
HRN, 1889.
VTN, 1896.
LB, 1906.

kauri-pine
A. australis
MSE, 1888.

kawaka cedar
Libocedrus Bidwillii
CCV, 1872.

kelp
Durvillaea utilis
CNZ, 1919.

Kermadec koromiko
Veronica breviracemosa
CNZ, 1919.

Kermadec nikau
Rhopalostylis Cheesemanii
CNZ, 1919.

*South Island form of Ngaio.

†When converted into timber and worked up, several names are applied:—black (= deep brown) k., red k., soft (= pale dun) k., white (= yellowish white) k., waved k., mottled k., and feathered k. KFF, pp. 145-46. These, however, have not been considered to be tree-names, and are not included in this list.

Kermadec pohutukawa
Metrosideros villosa
DDD (2), 1925.

Kermadec tree-fern
Cyathea kermadecensis
CNZ, 1919.

kidney fern
Trichomanes reniforme
POO, 1882.
FFN, 1890.
HFN, 1890.
CMN, 1906.
CWK, 1908.
DDD, 1917.
DFN, 1921.
DDD (2), 1925.

kidney-fern
T. reniforme
TFF, 1882.
FFN, 1890.
CSI, 1909.
THW, 1909.
CNZ, 1910.
CNZ, 1919.

kidney-leaf bristle fern
T. reniforme
LFN, 1875.

kindred coprosma
Coprosma propinqua
LB, 1906.

king fern
Marattia fraxinea
DDD, 1917.
DFN, 1921.
DDD (2), 1925.
Todea barbara
CNZ, 1919.

king-fern
Marattia fraxinea
CCN, 1924.

king-pine
Agathis australis
DRA, 1872.

king's fern
Leptopteris superba
POO, 1882.

Kirk's fireweed
Erechtites glabrescens
CSI, 1909.

Kirk's groundsel
Senecio Kirkii
CNZ, 1910.

Kirk's pine
Dacrydium Kirkii
CWK, 1908.
CSI, 1909.

Kirk's pittosporum
Pittosporum Kirkii
LB, 1906.
CWK, 1908.

Kirk's poa
Poa Kirkii
CIG, 1880.
NZJS, 1923.

knee-jointed fox-tail grass
Alopecurus geniculatus
CIG, 1880.

knot-jointed rice grass
Microlaena polynoda
CIG, 1880.

knotted rice-grass
Microlaena polynoda
NZJS, 1925.

kohai
Sophora tetraptera
HCE, 1844.

konini tree
Fuchsia excorticata
POO, 1882.

kopi-tree
Corynocarpus laevigata
NZCJ, 1888.
CNZ, 1919.

koradi
Phormium tenax
MAP, 1838.

koudi pine
Agathis australis
LNZ, 1839.

kowai
Sophora tetraptera
TCS, 1851.
Trans. 2, 1870.

kowdie pine
Agathis australis
KFF, 1889.

kowhia
Sophora tetraptera
PPO, 1868.

kraka
Corynocarpus laevigata
HNR, 1842.

lace bark
Gaya Lyalli
NC, 1912.
Hoheria populnea
SLM, 1902.
Plagianthus Lyallii
FAA, 1889.
HFZ, 1890.

lace-bark
Gaya Lyallii
KFF, 1889.
CMN, 1906.
Hoheria populnea
FAA, 1889.
KFF, 1889.
KSF, 1899.
CMN, 1906
CNZ, 1910.
GHB, 1910.
Plagianthus Lyallii
Trans. 1, 1869.
HNF, 1888.
MNZ, 1905.

lace bark tree
Plagianthus Lyallii
HRN, 1889.

lacebark
Gaya Lyallii
KSF, 1899.
CMN, 1906.
Hoheria angustifolia
CKB, 1915.
Hoheria populnea
DCO, 1900.
CWK, 1908.
THW, 1909.
DDD, 1917.
DDD (2), 1925.
Plagianthus betulinus
THW, 1909.

lace-bark tree
P. betulinus
Trans. 9, 1877.

lace fern
Paesia scaberula
DDD, 1917.
Pteris scaberula
DFN, 1921.
DDD (2), 1925.

lace-fern
Paesia scaberula
DMs., 1921.

lace wood
Hoheria populnea
FAA, 1889.

ladder fern
Dryopteris cordifolia
POO, 1882.

ladies' smock
Cardamine depressa
Trans. 1, 1869.

lady fern
Dryopteris thelypteris var. *squamulosum*
DFN, 1921.

lady-fern
Dryopteris thelypteris var. *squamulosum*
DMs., 1921

Laing's whipcord veronica
Veronica Laingii
CSI, 1909.

lance-leaved fern
Blechnum discolor
DMs., 1921.

lance-leaved hard fern
Blechnum lanceolatum
POO, 1882.
CTP, 1908.
CKB, 1915.

lance-leaved spleenwort
Asplenium adiantoides
POO, 1882.
CTP, 1908.

lance-leaved whitewood
Melicytus lanceolatus
CSI, 1909.

lance-wood
Pseudopanax crassifolium
Trans. 4, 1872.
Trans. 9, 1877.
MNZ, 1905.
DFC, 1916.

lancewood
Pseudopanax crassifolium
Trans. 12, 1880.
KFF, 1889.
MLN, 1890.
DCO, 1900.
CMN, 1906.
CKI, 1907.
CTP, 1908.
JM, 1909.
THW, 1909.
Trans. 42, 1910.
CKB, 1915
OTR, 1916.
DDD, 1917.
CNZ, 1919.
CCN, 1924.
DDD (2), 1925.

land-cress
Cardamine hirsuta.
KSF, 1899.

large adder's tongue
Ophioglossum lusitanium
POO, 1882.

large broadleaf
Grisilinia lucida
CKI, 1907.

large bulrush
Typha angustifolia
Trans. 1, 1869.

large-flowered broom
Carmichaelia grandiflora
CNZ, 1919.

large-flowered corysanthes
Corysanthes macrantha
LB, 1906.

large-flowered forstera
Forstera sedifolia var. *oculata*
CSI, 1909.

large-flowered kowhai
Sophora grandiflora
MNZ, 1905.
CNZ, 1919.

large-flowered libertia
Libertia grandifolia
LB, 1906.
CWK, 1908.

large-flowered New Zealand broom
Carmichaelia grandiflora
CNZ, 1919.

large flowered poa
Poa novae-zealandiae
CTP, 1908.

large-flowered poa
Poa foliosa
CIG, 1880.
Poa novae-zealandiae
CSI, 1909.

large-flowered raoulia
Raoulia grandiflora
CTP, 1908.
CNZ, 1919.

large-flowered ribbonwood
Gaya Lyallii
LB, 1906.

large-flowered spider-orchid
Corysanthes macrantha
CSI, 1909.

large-flowered veronica
Veronica amabilis var. *blanda*
CSI, 1909.

large leafed birch
Nothofagus fusca
CCV, 1872.

large-leaved alseuosmia
Alseuosmia macrophylla
LB, 1906.

large-leaved climbing rata
Metrosideros florida
CKI, 1907.
CWK, 1908.

large-leaved coprosma
Coprosma grandifolia
LB, 1906.
CKI, 1907.
CWK, 1908.

large-leaved doodia
Doodia media
POO, 1882.

large-leaved maidenhair
Adiantum affine
DMs., 1921.

large-leaved milk-tree
Paratrophis opaca
CKI, 1907.
CNZ, 1919.

large-leaved ourisia
Ourisia macrophylla
LB, 1906.
CTP, 1908.

large-leaved pohuehue
Muehlenbeckia australis
CNZ, 1919.

large-leaved totara
Podocarpus Hallii
CSI, 1909.

large-leaved tree-daisy
Olearia Colensoi
CNZ, 1919.

large-leaved whitewood
Melicytus macrophyllus
CWK, 1908.

large monkey-flower
Mimulus repens
VN, 1920.

large-toothed olearia
Olearia macrodonta
LB, 1906.

large white willow-herb
Epilobium pallidiflorum
CKI, 1907.
CSI, 1909.

lattice fungus
Clathrus cibarius
NZJS, 1922.

laurel
Corynocopia laevigata
CSJ, 1846.

laurel-tree
Beilschmiedia taraire
DRA, 1872.

Lavaud's veronica
Veronica Lavaudiana
LB, 1906.

lawyer
Rubus australis
LCN, 1868.
Trans. 3, 1871.
DCD, 1900.
SLM, 1902.
TIC, 1906.
CKI, 1907.
THW, 1909.
CNZ, 1910.
EM, 1911.

leafless clematis
Clematis afoliata
LB, 1906.
CKB, 1915
CNZ, 1919.
CCN, 1924.

leafless common New Zealand broom
Carmichaelia subulata
CNZ, 1919.

leafless lawyer
Rubus cissoides
CKB, 1915

leafy coprosma
Coprosma parviflora
CNZ, 1919.

leafy uncinia
Uncinia riparia
CSI, 1909.

leather-leaf
Senecio rotundifolius
MNZ, 1905.

leathern leaf
Senecio rotundifolius
Ver. (A).

leather plant
Celmisia coriacea
TCS, 1851.
HHN, 1867.
CMN, 1906.

leather-plant
Celmisia spectabilis
Trans. 30, 1898.
KSF, 1899.

leathery celmisia
Celmisia coriacea
LB, 1906.

lemon matipo
Pittosporum eugenioides
OTR, 1916.

lemon-tree
Pittosporum eugenioides
LB, 1906.

lemon-tree
Pittosporum tenuifolium
BGN, 1860.

lemon wood
Pittosporum eugenioides
NZCJ, 1878.
FAA, 1889.

lemon-wood
Melicope ternata
OTR, 1916.
Nothopanax Edgerleyi
THW, 1909.
Pittosporum eugenioides
THW, 1909.

lemonwood
Pittosporum eugenioides
Trans. 12, 1880.
CKI, 1907.
CWK, 1908.
CKB, 1915.

lesser caladenia
Caladenia minor
LB, 1906.

light-wood
Aristotelia racemosa
Trans. 31, 1899.

lignum vitæ
Dodonoea viscosa
FAA, 1889.

lignumvitae
Dodonoea viscosa
PNZ, 1838.

lily-palm
Cordyline australis
EM, 1912.

lily-wort
Cordyline sp.
Trans. 4, 1872.

lime-spleenwort
Asplenium obtusatum
CNZ, 1919.

lime tree
Aristotelia racemosa
Trans. 1, 1869.

Lindsay's mistletoe
Viscum Lindsayi
LB, 1906.

little adder's tongue
Ophioglossum lusitanicum
FFH, 1890.
DMs., 1921.

little adder's-tongue
Ophioglossum lusitanicum
FFN, 1890.

little filmy fern
Hymenophyllum minimum
POO, 1882.

little hard fern
Blechnum penna marinum
POO, 1882.

little maidenhair
Adiantum diaphanum
DMs., 1921.

little mountain-heath
Pentachondra pumila
CNZ, 1919.

little mountain tutu
Coriaria thymifolia
NZCJ, 1885.

little poa
Poa exigua
CIG, 1880.

little spaniard
Aciphylla Monroi
CNZ, 1919.

little tutu
Coriaria thymifolia
NZCJ, 1885.

locust tree
Sophora tetraptera
DRA, 1883.

locust-tree
Sophora tetraptera
DRA, 1872.

lofty electryon
Alectryon excelsum..
LB, 1906.

lofty pepper
Macropiper excelsum
LB, 1906.

long-awned plume grass
Dichelachne crinita
NZCJ, 1879.

long-haired plume-grass
Dichelachne crinita
CSI, 1909.
CDA, 1911.
CKB, 1915.
CNZ, 1919.

long-hair plume grass
Dichelachne crinita
CIG, 1880.

long hard fern
Blechnum capense
POO, 1882.
CTP, 1908.
CKB, 1915.
CNZ, 1919.

long hard-fern
Blechnum capeuse
CNZ, 1919.

long leaf matipou
Rapanea salicina
Ver. (WB).

long-leaved celmisia.
Celmisia longifolia
LB, 1906.

long-leaved grass-tree
Dracophyllum longifolium
LB, 1906.

long-leaved heath
Dracophyllum longifolium
TNN, 1909.

long-leaved lacebark
Hoheria sexstylosa
CNZ, 1919.

long-leaved matipo
Rapanea salicina
CKI, 1907.
CWK, 1908.

long-leaved pimelea
Pimelea longifolia
LB, 1906.

long-leaved thelymitra
Thelymitra longifolia
LB, 1906.

long-stalked sedge
Carex longiculmis
CSI, 1909.

long-stalked shield fern
Polystichum oculatum
POO, 1882.

long-stalked willow-herb
Epilobium pedunculare
CNZ, 1919.

long-stemmed marsh-pennywort
Hydrocotyle elongata
CKB, 1915.

long-stemmed willow-herb
Epilobium pedunculare
CSI, 1909.

long-stemmed willowherb
Epilobium pedunculare
CTP, 1908.
THW, 1909.

loose-leaved dacrydium
Dacrydium laxifolium
LB, 1906.

loranth
Loranthus micranthus
POO, 1882.

lowland ribbonwood
Plagianthus betulinus
CKB, 1915.
CNZ, 1919.
CCN, 1924.

loxsoma fern
Loxsoma Cunninghami
POO, 1882.
CWK, 1908.

luma-luma
Coprosma foetidissima
HHN, 1867.

Lyall's bristle fern
Trichomanes Lyallii
POO, 1882.
CWK, 1908.

Lyall's bristle-fern
Trichomanes Lyallii
CSI, 1909.

Lyall's caladenia
Caladenia Lyallii
CSI, 1909.

Lyall's drapetes
Drapetes Lyallii
CSI, 1909.

Lyall's groundsel
Senecio Lyallii
CSI, 1909.

Lyall's pimelea
Pimelea Lyallii
CSI, 1909.
CDA, 1911.

Lyall's ranunculus
Ranunculus Lyallii
LB, 1906.

Lyall's spleenwort
Asplenium Lyallii
CSI, 1909.

Lyall's stilbocarpa
Stilbocarpa Lyallii
LB, 1906.

lycopodium-like veronica
Veronica lycopodioides
LB, 1906.

Mabel Island lily
Arthropodium cirratum
CNZ, 1919.

Macquarie cabbage
Myosotidium nobile
CNZ, 1910.
CNZ, 1919.

Magellan's oxalis
Oxalis magellanica
LB, 1906.

mahogany pine
Podocarpus totara
HNZ, 1857.
PPO, 1868.

mahogany-pine
Podocarpus totara
MSE, 1888.

maiden hair
Adiantum affine
HNF, 1890.

maidenhair
Adiantum
TFF, 1882.
Adiantum aethiopicum
DFN, 1921.

maidenhair spleenwort
Asplenium Hookerianum
CTN, 1908.
Asplenium trichomanes
DFN, 1921.

Maling's fern
Hymenophyllum Malingii
POO, 1882.

mangrove
Avicennia officinalis
CV, 1769.
TIM, 1855.
CMN, 1906.
LB, 1906.
CNZ, 1910.
Trans. 44, 1912.

manuca (= manuka)
Leptospermum scoparium
ASC, 1853.

manuka broom
Leptospermum scoparium
LB, 1906.

Maori cabbage
Brassica oleracea
KSF, 1899.

manuko *See* gadoa

*Maori fire
Pennantia corymbosa
Ver. (Stony Bay, Banks Pen.)

*So called because used for Maori fire-sticks; the tree is also personified as Hine-kaikomako.

Maori heads
Carex secta
Carex virgata
ATO, 1897.

Maori holly
Olearia ilicifolia
NZCJ, 1878.

Maori onion
Chrysobactron Hookeri
CTP, 1908.
Chrysobactron Rossii
LB, 1906.
MK, 1908.

*Maori pain-killer
Wintera (= Drimys) axillaris
FAA, 1889.

Maori parsnip
Anisotome Lyallii
HHN, 1867.
Trans. 1, 1869.

Maori-vine
Muehlenbeckia australis
CCN, 1924.

maple
Pittosporum Colensoi
Trans. 9, 1877.
Pittosporum eugenioides
Trans. 9, 1877.
LB, 1906.
Pittosporum tenuifolium
Trans. 9, 1877.
Rapanea Urvillei
Trans. 9, 1877.

mappo
Rapanea Urvillei
BSL, 1870.

mapu
Pittosporum eugenioides
KFF, 1889.

March-flowering gentian
Gentiana Griesbachii
NZJS, 1921.

marginate luzuriaga
Enargea parviflora
LB, 1906.

marie (= maire)
Olea Cunninghamii
OTR, 1916.

mariscus-sedge
Mariscus ustulatus
CNZ, 1919.

marsh buckler-fern
Dryopteris thelypteris var. *squaumulosa*
FFN, 1890.

marsh-buttercup
Ranunculus rivularis
CTP, 1908.
THW, 1909.

marsh cress
Nasturtium palustra
FAA, 1889.

marsh cudweed
Guaphalium paludosum
CTP, 1908.

marsh fern
Dryopteris thelypteris var. *squamulosa*
POO, 1882.

marsh foxtail
Alopecurus geniculatus
CMN, 1906.
DFC, 1916.

marsh haloragis
Halorrhagis micrantha
CTP, 1908.

marsh marygold
Caltha novae zelandiae
Trans. 1, 1869.

marsh reed
Typha angustifolia
MTN, 1834.

marsh-rush
Typha angustifolia
RHH, 1897.

marsh-samphire
Salicornia australis
Trans. 4, 1872.

matagowry
Discaria toumatou
Ver.

mat-raoulia
Raoulia tenuicaulis
CNZ, 1919.

matted club-moss
Lycopodium ramulosum
CSI, 1909.

meadow rice grass
Microlaena stipoides
NZCJ, 1879.
CIG, 1880.
CWK, 1908.

meadow rice-grass
Microlaena stipoides
CWK, 1908.
CDA, 1911.

membrane-leaved fern
Blechnum membranaceum
POO, 1882.
CWK, 1908.
CKB, 1915.

Menzies' beech
Nothofagus Menziesii
LB, 1906.

mermaids' beads
Chaetomorpha Darwinii
Ver.

mikimik
Copromsa linarifolia
LCN, 1868.

milk tree
Paratrophis microphylla
Trans. 1, 1869
TNN, 1909.
DFC, 1916.

milk-tree
Paratrophis microphylla
HHN, 1867.
CCV, 1872.
Trans. 12, 1880.
Trans. 29, 1897.
CMN, 1906.
LB, 1906.
CWK, 1908.
THW, 1909.
CNZ, 1910.
CKB, 1915.

milk wood
Paratrophis microphylla
Ver. (Stony Bay, B.P.)

†milkwood
Paratrophis microphylla
NZJS, 1924.
Ver. (WB.).

Milne's tree-fern
Cyathea Milnei
POO, 1882.

* "A decoction of the leaves is known as Maori pain-killer, and I have heard the tree itself so called."—FAA, p. 13.

†So written in communication from WB.

mimic tree-fern
Blechnum Fraseri
DMs., 1921.
miniature tree-fern
Blechnum Fraseri
CWK, 1908.
CNZ, 1919.
mint
Mentha Cunninghamii
Trans. 1, 1869.
Trans. 2, 1870.
TNN, 1909.
minute poa
Poa foliosa
CIG, 1880.
mistletoe
Loranthus micranthus
POO, 1882.
moko-mok
Aristotelia racemosa
LB, 1906.
moko moko (= makomako)
Aristotelia racemosa
ATO, 1897.
Monro's Spaniard
Aciphylla Monroi
LB, 1906.
moonwort
Botrychium
TFF, 1882.
Botrychium australe
CKB, 1915.
Botrychium lunaria
FFN, 1890.
CNZ, 1919
Botrychium ternatum
LFN, 1875.
POO, 1882.
moss fern
Leptopteris superba
POO, 1882.
mother-fern
Asplenium bulbiferum
DMs., 1921.
mountain-akeake
Olearia avecinniaefolia
CNZ, 1919.
mountain-astelia
Astelia montana
CNZ, 1919.
mountain aster
Celmisia sp.
NZCJ, 1885.
NZCJ, 1888.
mountain beech
Nothofagus cliffortioides
KFF, 1889.
HMB, 1898.
DCO, 1900.
CMN, 1906.
DDD, 1917.
DDD (2), 1925.
mountain-beech
Nothofagus cliffortioides
MNZ, 1905.
CTP, 1908.
THW, 1909.
mountain birch
Nothofagus cliffortioides
CMN, 1906.
mountain broad-leaved filmy fern
Hymenophyllum atrovirens
POO, 1882.
mountain-buttercup
Ranunculus insignis
THW, 1909.
mountain cabbage-tree
Cordyline indivisa
THW, 1909.
mountain cassinia
Cassinia Vauvilliersii
CTP, 1908.
mountain cedar
Libocedrus Bidwillii
Ver. (WB).
mountain-cedar
Libocedrus Bidwillii
THW, 1909.
mountain celery pine
Phyllocladus alpinus
LB, 1906.
mountain celery-pine
Phyllocladus alpinus
MNZ, 1905.
mountain club-moss
Lycopodium scariosum
CNZ, 1919.
mountain-cottonwood
Cassinia Vauvilliersii
CNZ, 1919.
mountain-cotula
Cotula pyrethrifolia
CNZ, 1919.
mountain-currant
Aristotelia fruticosa
CSI, 1909.
CNZ, 1910.
mountain daisy
Celmisia coriacea
LB, 1906.
MK, 1908.
Helichrysum bellidioides
MHG, 1885.
CTP, 1908.
mountain daisy
Olearia insignis
HRN, 1889.
mountain-daisy
Helichrysum bellidioides
THW, 1909.
CKB, 1915.
mountain flax
Phormium Colensoi
THW, 1909.
mountain-flax
Phormium Colensoi
CTP, 1908.
THW, 1909.
CNZ, 1919.
mountain forget-me-not
Myosotis Traversii
NZCJ, 1885.
mountain-foxglove
Ourisia macrophylla
CNZ, 1919.
mountain-gentian
Gentiana bellidifolia
CNZ, 1919.
Gentiana corymbifera
MHG, 1885.
mountain-holly
Olearia ilicifolia
CCN, 1924.
mountain ivy-tree
Nothopanax Colensoi
CTP, 1908.
CNZ, 1919.
mountain korokio
Corokia Cotoneaster
CCN, 1924.
mountain-korokio
Corokia Cotoneaster
CNZ, 1919.
mountain lancewood
Pseudopanax lineare
CCN, 1924.
mountain lily
Ranunculus Lyallii
Trans. 12, 1880.
MHG, 1885.
HNF, 1888.
FAA, 1889.
MLN, 1890.
Z, 1890.
DCO, 1900.
MK, 1908.
NC, 1912.

mountain-lily
Ranunculus Lyallii
CNZ, 1910.
CNZ, 1919.
CCN, 1924.

mountain-loving veronica
Veronica monticola
LB, 1906.

mountain marguerite
Senecio scorzoneroides
CCO, 1900.

mountain musk
Celmisia incana
CTP, 1908.

*mountain-musk
Celmisia discolor
CCO, 1900.
Celmisia incana
CNZ, 1919.
Celmisia Sinclairii
CCO, 1900.

mountain neinei
Dracophyllum Traversii
CNZ, 1924.

mountain-neinei
Dracophyllum Traversii
CNZ, 1919.

mountain palm
Cordyline indivisa
OTR, 1916.
DDD, 1917.

mountain panax
Nothopanax Sinclairii
DDD, 1917.

mountain-panax
Nothopanax Colensoi
CSI, 1909.

mountain pine
Dacrydium Bidwillii
KFF, 1889.
Dacrydium intermedium
KFF, 1889.
CMN, 1906.
DDD, 1917.
DDD (2), 1925.

mountain-pine
Dacrydium Bidwillii
CSI, 1909.
CNZ, 1919.

mountain-piripiri
Acaena Sanguisorbae var. *pilosa*
CNZ, 1919.

mountain primula
Ourisia macrophylla
HFZ, 1890.
OTR, 1916.
DDD (2),1925.

mountain rata
Metrosideros lucida
MNZ, 1905.
CMN, 1906.

mountain-rata
Metrosideros lucida
CSI, 1909.

mountain ribbon-wood
Gaya Lyallii
TIC, 1906.
CNZ, 1919.

mountain ribbonwood
Plagianthus Lyallii
TNN, 1909.
CNZ, 1919.

mountain-ribbonwood
Gaya Lyallii
CNZ, 1919.
CCN, 1924.

mountain rimu
Dacrydium laxifolium
KFF, 1889.
DDD, 1917.

mountain-sedge
Carex dissita var. *monticola*
CSI, 1909.

mountain-snowberry
Gaultheria depressa
CNZ, 1919.

mountain southern-beech
Nothofagus Cliffortioides
Trans. 48, 1916.
CNZ, 1919.
CCN, 1924.

mountain-tawheowheo
Quintinia acutifolia
CNZ, 1919.

mountain toatoa
Phyllocladus alpinus
KFF, 1889.
CMN, 1906.
CCN, 1924.

mountain-toatoa
Phyllocladus alpinus
CTP, 1908.
CNZ, 1919.
DDD (2), 1925.
(mis-spelt totoa)

mountain totara
Podocarpus nivalis
CCV, 1872.
LB, 1906.

mountain-totara
Podocarpus Hallii
THW, 1909.
CNZ, 1919.
Podocarpus nivalis
CTP, 1908.
Trans. 48, 1916.
CCN, 1924.

mountain totoa
Phyllocladus alpinus
DDD, 1917.

mountain tree-daisy
Olearia Colensoi
CNZ, 1919.

mountain tree-fern
Alsophila Colensoi
POO, 1882.
CSI, 1909.

mountain tussock grass
Poa Colensoi var. *intermedia*
NSCJ, 1879.

mountain-twitch
Triodia exigua
CNZ, 1919.

mountain umbrella-fern
Gleichenia alpina
CNZ, 1919.

mountain uncinia
Uncinia compacta
CSI, 1909.

mountain water-willowherb
Epilobium macropus
CTP, 1908.

mountain willow-herb
Epilobium chloraefolium
CNZ, 1919.

mountain wineberry
Aristotelia fruticosa
CTP, 1908.
CNZ, 1919.
CCN, 1924.

mountain-wineberry
Aristotelia fruticosa
CNZ, 1919.

mountain yellow buttercup
Ranunculus nivicola
DDD (2), 1925.

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* "This plant the shepherds call the mountain-musk, and smoke it mingled with tobacco for the fragrance it affords." CCO, p. 210.

Mount Cook bent
Deyeuxia Youngii
NZCJ, 1879.

Mount Cook lily
Ranunculus Lyallii
HFZ, 1890.
CMN, 1906.

Mount Egmont buttercup
Ranunculus nivicola
CNZ, 1910.

Mount Egmont primula
Ourisia macrophylla
DDD, 1917.

mouse ear
Myrtus obcordata
Ver. (WB)

musk
Mimulus repens
CNZ, 1910.

musk-tree
Olearia Colensoi
Trans. 12, 1880.

musky olearia
Olearia moschata
LB, 1906.

musky tree-daisy
Olearia moschata
CNZ, 1919.

mutton-bird plant
Cotula Featherstonii
CNZ, 1910.
CNZ, 1919.

mutton bird scrub
Olearia Colensoi
Senecio rotundifolius
Z. 1889.

mutton-bird scrub
Olearia Colensoi
Trans. 42, 1910.
Senecio rotundifolius
MNZ, 1905.
CNZ, 1919.
Senecio sciadophilus
LB, 1906.

mutton-bird shrub
Senecio rotundifolius
CCN, 1924.

mutton-bird-wood
mutton-wood
Olearia Colensoi
KFF, 1889.

myrtle
Metrosideros scandens
FAA, 1859
Myrtus bullata
NC, 1912.
Myrtus obcordata
Trans. 2, 1870.
KFF, 1889.

naked oat grass
Danthonia nuda
CIG, 1880.

naked phebalium
Phebalium nudum
LB, 1906.

narrow adder's tongue
Ophioglossum lusitanicum
DFN, 1921.

narrow hard-fern
Blechnum alpinum
DMs, 1921.

narrow-leaved adder's tongue
Ophioglossum lusitanicum
DFN, 1921.

narrow-leaved cassinia
Cassinia leptophylla
LB, 1906.

narrow-leaved celmisia
Celmisia linearis
CSI, 1909.

narrow-leaved coprosma
Coprosma linarifolia
LB, 1906.
CTP, 1908.
CKB, 1915.

narrow-leaved hinehine
Melicytus lanceolatus
MNZ, 1905.

narrow-leaved hooded orchid
Pterostylis graminea
CWK, 1908.

narrow-leaved lacebark
Hoheria angustifolia
CNZ, 1919.
CCN, 1924.

narrow-leaved lawyer
Rubus subpauperatus
CSI, 1909.

narrow-leaved lindsaya
Lindsaya linearis
POO, 1882.
CWK, 1908.

narrow leaved maire
Olea montana
DDD, 1917.

narrow-leaved maire
Olea montana
MNZ, 1905.
CMN, 1906.
CKI, 1907.
CWK, 1908.

narrow-leaved nothopanax
Nothopanax lineare
LB, 1906.

narrow-leaved oat tussac grass
Danthonia Raoulii
CIG, 1880.

narrow-leaved oreobolus
Oreobolus strictus
CSI, 1909.

narrow-leaved polypody
Polypodium Billardieri
POO, 1882.
Polypodium diversifolium
CTP, 1908.

narrow-leaved snowberry.
Gaultheria perplexa
CSI, 1909.

narrow-leaved uncinia
Uncinia caespitosa
CTP, 1908.

narrow-leaved willowherb
Epilobium cinereum
CSI, 1909.
CKB, 1915.
Epilobium junceum
CKI, 1907.
CWK, 1908.

narrow Lindsaya
Lindsaya linearis
DMs., 1921.

native anise
Angelica Ginigidium
NZJS, 1921.

native aniseed
Angelica Gingidium
LB, 1906.
DFC, 1916.
DDD, 1917.

native arbutilon
Rhabdothamnus Solandri
DDD, 1917.
DDD (2), 1925.
(mis-spelt abutilon)

native ash
Alectryon excelsum
DCO, 1900.

native bamboo
Microlaena polynoda
DDD, 1917.

native beech
Fagus Menziesii
DDD, 1917.

native begonia
Elatostema rugosum
DDD, 1917.

native bignonia
Rhabdothamnus Solandri
DDD, 1917.

native blue bell
Wahlenbergia albo-marginata
LCN, 1868.

native bramble
Rubus australis
FAA, 1889.
TIC, 1906.

native broom
Carmichaelia flagelliformis
FAA, 1889.
DCO, 1900.
DFC, 1916.
Carmichaelia subulata
Trans. 46, 1914.

native burr
Acaena Sanguisorbae
LCN, 1868.
FAA, 1889.

native carrot
Daucus brachiatus
TIC, 1906.
TNN, 1909.

native cedar
Dysoxylum spectabile
FAA, 1889.
Libocedrus Bidwillii
MLN, 1890.
DFC, 1896.
MNZ, 1905.
DFC, 1916.

native celery
Apium prostratum
HHN, 1867.

native clematis
Clematis indivisa
CKI, 1907.
CWK, 1908.

native convolvulus
Calystegia tuguriorum
CKI, 1907.

native cork wood
Entelea arborescens
RDT, 1875.

native current
Aristotelia racemosa
Trans. 30, 1898.
CTP, 1908.
MK, 1908.
TNN, 1909.
CNZ, 1910.

native cypress
Libocedrus Bidwillii
DDD, 1917.

native daisy
Brachycome Sinclairii
KSF, 1899.
Lagenophora Forsteri
KSF, 1899.
Lagenophora pumila
HHN, 1867.
CKI, 1907.
CWK, 1908.

native everlasting
Helichrysum bellidioides
TNN, 1909.

native fig
Schefflera digitata
CKI, 1907.
CWK, 1908.

native flax
Linum monogynum
HHN, 1867.
Phormium tenax
TNC, 1856.
BOS, 1900.
NZJS, 1921.
NZJS, 1923.

native fuchsia
Fuchsia excorticata
POO, 1882.
HMB, 1898.
CTP, 1908.
CNZ, 1910.
EM, 1911.
DDD, 1917.

native geranium
Geranium microphyllum
DCO, 1900.

native groundsel
Erechtites prenathoides
Trans. 31, 1899.

native harebell
Wahlenbergia gracilis
DCO, 1900.

native hawthorn
Discaria toumatou
HHN, 1867.

native heath
Dracophyllum longifolium
HGC, 1865.
Epacris pauciflora
DDD, 1917.
Gaultheria antipoda
TIC, 1906.
Leucopogon Fraseri
HHN, 1867.
DCO, 1900.

*Native heather
?*Cassinia leptophylla*
PPO, 1868.

native hemp
Phormium tenax
CVS, 1773.
PAS, 1841.

native holly
Olearia ilicifolia
MLN, 1890.
MNZ, 1905.
CSI, 1909.
CNZ, 1910.
DDD, 1917.
CNZ, 1919.
DDD (2), 1925.
Olearia macrodonta
MNZ, 1905.

native honey-suckle
Knightia excelsa
DDD, 1917.

native honeysuckle
Knightia excelsa
DDD (2), 1925.

native ice-plant
Mesembryanthemum australe
HHN, 1867.
Tetragonia expansa
HHN, 1867.

native iris
Liberta ixioides
DCO, 1900.

*" The rose and the laburnum intermingle their blossoms with those of the clianthus and the mimosa; the English primrose and the Scottish bluebell nestle amidst lovely New Zealand ferns; the modest gowan mingles with sweet-scented native heather; honey-suckles twine around cottage-porches, in company with the native clematis and the thick-spreading native convulvulus; and fragrant violets bloom beneath the shade of picturesque palm-trees." PPO, p. 21.

native laburnum
Sophora tetraptera
LCN, 1868.

native laurel
Myoporum laetum
PLC, 1857.

native lilac
Quintinia serrata
FAA, 1889.

native mimosa
Sophora tetraptera
LCN, 1868.

native mint
Mentha Cunninghamii
DFC, 1896.
DFC, 1916.

native mistletoe
Loranthus sp.
DCO, 1900.

native mulberry
Entelea arborescens
Trans. 3, 1871.

native myrtle
Myrtus bullata
DDD, 1917.
Myrtus obcordata
TNN, 1909.

Native Oat Grass
Tristetum antarcticum
NZCJ, 1879.

native parsley
Anisotome sp.
OTR, 1916.

native passion-flower
Tetrapathaea australis
DCO, 1900.

native passion-vine
Tetrapathaea australis
Trans. 43, 1911.

native pepper
Macropiper excelsum
HHN, 1867.

native sandalwood
Fusanus Cunninghamii
Trans. 28, 1896.

native sarsaparilla
Rhipogonum scandens
HHN, 1867.

native scabweed
Raoulia lutescens
NZJS, 1921.

native screw-pine
Freycinetia Banksii
CKI, 1907.

native teak
Metrosideros lucida
PPO, 1868.

native thorn
Discaria toumatou
HHN, 1867.
FAA, 1889.

native thyme
Pimelea laevigata
GST, 1921.

native violet
Viola filicaulis
FAA, 1889.
Viola Cunninghamii
TNN, 1909.

Native Water Milfoil
Myriophyllum elatinoides
FAA, 1889.

necklace fern
Asplenium flabellifolium
DFN, 1921.

needle-leaved celmisia
Celmisia laricifolia
CNZ, 1919.

needle-leaved heath
Dracophyllum longifolium
CCO, 1900.
CNZ, 1919.

needle-leaved poa
Poa acicularifolia
CIG, 1880.

net fungus
Clathrus cibarius
Ver.

nettle
Urtica ferox
DFC, 1896.
Urtica incisa
Trans. 1, 1869.
Trans. 2, 1870.

nettle tree
Urtica ferox
Trans. 1, 1869.
HMB, 1898.

New Zealand acacia
Sophora grandiflora
Trans. 1, 1869
Trans. 9, 1877

New Zealand acaena
Acaena novae-zelandiae
LB, 1906.

New Zealand aniseed
Angelica montana
CKB, 1915.

New Zealand arbor vitae
Libocedrus doniana
CWK, 1908.

New Zealand arbor-vitæ
Libocedrus doniana
HHW, 1867.
Trans. 4, 1872.
KFF, 1889.
CMN, 1906.

New Zealand ash
Alectryon excelsum
Trans. 3, 1871.
KFF, 1889.
LB, 1906.
CKI, 1907.
CWK, 1908.
CKB, 1915.
Metrosideros tomentosa
HNP, 1867.

New Zealand atropis
Atropis novae-zelandiae
CSI, 1909.

New Zealand bed-straw
Galium umbrosum
CSI, 1909.

New Zealand begonia
Elatostema rugosum
DDD (2), 1925.

New Zealand bent-grass
Agrostis Dyeri
CTP, 1908.
CSI, 1909.

New Zealand blue bell
Wahlenbergia albomarginata
MLN, 1890.
NC, 1912.

New Zealand blue-bell
Wahlenbergia albomarginata
CSI, 1909.
CDA, 1911.

New Zealand bluebell
Wahlenbergia albomarginata
CNZ, 1919.
Wahlenbergia gracilis
CNZ, 1910.

New Zealand box
Veronica buxifolia
TIC, 1906.
CTP, 1908.
Veronica buxifolia var. *odora*
CSI, 1909.

New Zealand bramble
Rubus australis
TIM, 1855.
BGN, 1860.
Trans. 1, 1869.
LB, 1906.
TIC, 1906.

New Zealand broom
Carmichaelia australis
OTR, 1916.
Carmichaelia flagelliformis
THW, 1909.

New Zealand burr
Acaena novae-zelandiae
THW, 1909.
Acaena Sanguisorbae
THW, 1909.

New Zealand burr-reed
Sparganium subglobosum
CNZ, 1919.

New Zealand calceolaria
Jovellana Sinclairii
CNZ, 1919.

New Zealand caltha
Caltha novae-zealandiae
LB, 1906.
CSI, 1909.

New Zealand cedar
Dysoxylum spectabile
HNP, 1867.
LB, 1906.
CKI, 1907.
CNZ, 1910.
CNZ, 1919.
Ver. (WB)
Libocedrus doniana
CWK, 1908.

New Zealand celery
Apium prostratum
CKI, 1907.

New Zealand chickweed.
Stellaria gracilenta
NZCJ, 1885.

New Zealand Christmas tree
Metrosideros tomentosa
OTR, 1916.

New Zealand clematis
Clematis indivisa
CKB, 1915.

*New Zealand coffee
Coprosma sp.
DCO, 1900.

New Zealand convolvulus
Calystegia tuguriorum
CKB, 1915.

New Zealand cress
Cardamine heterophylla
HNP, 1867.

New Zealand currant
Aristotelia racemosa
HMB, 1898.
LB, 1906.
TIC, 1906.

New Zealand cypress
Libocedrus Bidwillii
OTR, 1916.
Libocedrus doniana
DDD, 1917.

New Zealand daisy
Celmisia sp.
HGC, 1865.
Lagenophora pumila
CSI, 1909.
Lagenophora petiolata
CTP, 1908.
THW, 1909.

New Zealand dandelion
Taraxacum magellanicum
CKI, 1907.
CSI, 1909.
CKB, 1915.

New Zealand daphne
Pimelia longifolia
DDD, 1917.
DDD (2), 1925.

New Zealand dock
Rumex flexuosus
CKB, 1915.

New Zealand donatia
Donatia novae-zelandiae
CSI, 1909.

New Zealand eldelweiss
Leucogenes grandiceps.
MHG, 1885.
HNF, 1888.
Trans. 26, 1894.
LB, 1906.
CSI, 1909.
CNZ, 1910.
DDD, 1917.
Leucogenes Leontopodium
Trans. 30, 1898.
CNZ, 1919.

New Zealand eyebright
Euphrasia zelandica
LB, 1906.

New Zealand fig
Schefflera digitata
CKB, 1915.

New Zealand fir
Agatha australis
NZJ, 1846.

†New Zealand flax
Phormium Colensoi
CKI, 1907.
CNZ, 1919.
Phormium tenax
NZJ, 1840
PAS, 1841.
HNZ, 1857.
HHN, 1867.
Trans. 1, 1869.
CMN, 1906.
LB, 1906.
TNN, 1909.
DFC, 1916.
CNZ, 1919.
CCN, 1924.

‡New-Zealand flax
Phormium tenax
MAP, 1838.

*See J. C. Crawford on coffee-producing plants, Trans. 9, p. 545, 1877. Good coffee from *C. lucida*, and *C. baueriana* suggested as good.

† . . . "so called from the flax-like properties of its fibre; not from any resemblance it bears to the insignificant-looking plant of Europe." HNZ, p. 88.

. . . . "its chief peculiarity consists in the fibre being obtained in the leaf, and not, as the case with the European flax, from the stem; . . ." BRP, p. 94.

Noted as flowering in France in May, 1813. NNV, vol. 2, p. 135.

‡New-Zealand is consistently hyphened throughout the book.

native
Sc' Zealand flax-plant
hormium tenax
BGN, 1860.
r
New Zealand fuchsia
Fuchsia excorticata
MNZ, 1905.
NC, 1912.
CKB, 1915.

New Zealand gum tree
Nothopanax Colensoi
TNN, 1909.

New Zealand hawthorn
Carpodetus serratus
CKI, 1907.
CTP, 1908.
CKB, 1915.

New Zealand herpolirion
Herpolirion novae-zelandiae
LB, 1906.

New Zealand hibiscus
Hibiscus trionum
FAA, 1889.

New Zealand hickory
Phyllocladus alpinus
KFF, 1889.

New Zealand holly
Olearia ilicifolia
MK, 1908.
NC, 1912.
OTR, 1916.
CNZ, 1919.

New Zealand honeysuckle
Knightia excelsa
CKI, 1907.
THW, 1909.
CNZ, 1910.
OTR, 1916.
CNZ, 1919.

New Zealand hydrocotyle
Hydrocotyle novae zelandiae
LB, 1906.

New Zealand ice-plant
Mesembryanthemum australe
CNZ, 1910.
CNZ, 1919.

New Zealand jasmine
Parsonsia heterophylla
CKI, 1907.
CWK, 1908.
CKB, 1915.
CNZ, 1919.

New Zealand Kaikoura buttercup
Ranunculus lobulatus
CNZ, 1919.

New Zealand laburnum
Sophora grandiflora
Sophora microphylla
CNZ, 1910.
Sophora tetraptera
BGN, 1860.
SLM, 1902.
LB, 1906.
CWK, 1908.
THW, 1909.

New Zealand laurel
Corynocarpus laevigata
MLN, 1890.
KSF, 1899.
SLM, 1902.
LB, 1906.
CKI, 1907.
CWK, 1908.
NC, 1912.
Griselinia littoralis
Trans. 9, 1877

New Zealand lignum vitae
Dodonoea viscosa
Trans. 1, 1869

New Zealand lilac
Quintinia serrata
KFF, 1889.
KSF, 1899.
Veronica Hulkeana
CNZ, 1910.
CNZ, 1919.

New Zealand lily
Arthropodium cirratum
CSJ, 1846.
NZJ, 1848.

New Zealand mahogany pine
Podocarpus totara
HNP, 1867.

New Zealand marsh-marigold
Caltha novae zealandiae
CSI, 1909.

New Zealand marsh pennywort
Hydrocotyle novae-zealandiae
CWK, 1908.

New Zealand marsh-pennywort
Hydrocotyle novae-zealandiae
CKI, 1907.
CSI, 1909.
CDA, 1911.
CKB, 1915.

New Zealand mint
Mentha Cunninghamii
CSI, 1909.

New Zealand mulberry
Enteleá arborescens
LB, 1906.
OTR, 1916.

New Zealand musk
Mimulus repens
CNZ, 1919.

New Zealand myrtle
Myrtus bullata
CSJ, 1846.
NZJ, 1848.
GHB, 1910.
OTR, 1916.

New Zealand oak
Alectryon excelsum
MLN, 1890.
OTR, 1916.
DDD, 1917.
Pittosporum eugenioides
HEC, 1915.
Vitex lucens
YNZ, 1835.
HNP, 1867.
Trans. 1, 1869
KFF, 1889.
LB, 1906.

New Zealand oak-elm
Metrosideros robusta
HNP, 1867.

New Zealand oat grass
Danthonia semiannularis
CIG, 1880.

New Zealand olive
Olea
CNZ, 1919.
Olea apetala
HMB, 1898.
Trans. 43, 1911.
Sideroxylon novozelandicum
Trans. 43, 1911.

New Zealand orache
Atriplex Billardieri
CSI, 1909.
CNZ, 1919.

New Zealand orange blossom
Hoheria populnea
FAA, 1889.

New Zealand pachycladon
Pachycladon novaezelandiae
LB, 1906.

New Zealand palm
Rhopalostylis sapida
Trans. 1, 1869

New Zealand passion-flower
Tetrapathaea australis
CKI, 1907.
CWK, 1908.
CNZ, 1910.
Trans. 44, 1912.
CNZ, 1919.

New Zealand passionflower
Tetrapathaea australis (tetrandra)
CCN, 1924.

*New Zealand pin-cushion
Raoulia mammillaris
NZCJ, 1885.

New Zealand pink broom
Notospartium torulosum
NC, 1912.

New Zealand pitch pine
Phyllocladus trichomanoides
HNP, 1867.

New Zealand plantain
Plantago Raoulii
CNZ, 1919.

New Zealand privet
Geniostoma ligustrifolia
CKI, 1907.
CWK, 1908.

New Zealand red pine
Dacrydium cupressinum
HNP, 1867.

New Zealand reed
Arundo conspicua
CTP, 1908.
THW, 1909.
CDA, 1911.
CKB, 1915.

New Zealand sandal-wood
Fusanus Cunninghamii
KFF, 1889.
CMN, 1906.
Olea Cunninghamii
HNP, 1867.

New Zealand sandalwood
Fusanus Cunninghamii
CWK, 1908.

New Zealand's bird's nest fern
Blechnum discolor
DDD, 1917.

New Zealand screw-pine
Freycinetia Banksii
CWK, 1908.
CNZ, 1910.
CNZ, 1919.

New Zealand's damson
Beilschmiedia tawa
HNZ, 1857.

New Zealand sheep's fescue
Festuca ovina var. *novae-zelandiae*
NZJS, 1923.

† New Zealand spinach
Tetragonia expansa
CSJ, 1846.
NZJ, 1848.
HHN, 1867.
HNP, 1867.
Trans. 1, 1869.
MSE, 1888.
KSF, 1899.
CMN, 1906.
LB, 1906.
CSI, 1909
TNN, 1909.
CNZ, 1910.
Trans. 43, 1911.
CNZ, 1919.

New Zealand's pine-apple
Freycinetia Banksii
HNP, 1863.

New Zealand spurge
Euphorbia glauca
CSI, 1909.
CDA, 1911.

New Zealand teak
Vitex lucens
HNP, 1867.
Trans. 3, 1871.
RDT, 1875.
KFF, 1889.
Ver. (WB).

New Zealand thorn
Discaria toumatou
Trans. 1, 1869

New Zealand violet
Viola Cunninghamii
CNZ, 1910.
Trans. 46, 1914
CNZ, 1919.
DDD (2), 1925.

New Zealand water-pimpernel
Samolus repens var. *procumbens*
CKI, 1907.

New Zealand willow
Veronica salicifolia
LCN, 1868.

New Zealand wind grass
Stipa arundinacea
CIG, 1880.

New Zealand wine-berry
Aristotelia racemosa
FAA, 1889.
OTR, 1916.

New Zealand yellow pine
Agathis australis
HNP, 1867.

New Zealand yew
Podocarpus totara
STT, 1850.

nigger head
Carex secta
DFC, 1916.

nigger-head
Carex secta
CMN, 1906.
Carex virgata
POO, 1882.
DCO, 1900.

niggerhead
Carex secta
LB, 1906.
CKI, 1907.
CSI, 1909.
CNZ, 1910.
CDA, 1911.
Trans. 48, 1916.
CNZ, 1919.
CCN, 1924.

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*"It is also called the New Zealand pincushion, and is often used for that purpose by the shepherds' wives." T. W. Adams, NZCJ vol. 9, 1885, p. 140.

†"This has long been cultivated in Europe as an edible plant, under the name of 'New Zealand spinach.'" CMN, p. 192.

nightshade
Solanum nigrum
HHN, 1867.
Trans. 2, 1870.

nika-palm
Rhopalostylis sapida
MSE, 1888.

nikau palm
Rhopalostylis sapida
Trans. 1, 1869
Trans 10, 1878.
HNF, 1888.
MLN, 1890.
BOS, 1900.
LB, 1906.
TIC, 1906.
CWK, 1908.
TNN, 1909.

nikau-palm
Rhopalostylis sapida
CMN, 1906.
CKI, 1907.
Trans. 44, 1912.
OTR, 1916.
CNZ, 1919.

nodding club-moss
Lycopodium varium
CNZ, 1919.

nodding club-rush
Scirpus filiformis
CSI, 1909.
CDA, 1911.

nodding plumed poa
Poa anceps
CTP, 1908.
THW, 1909.
Poa anceps var. *elata*
CIG, 1880.

northern lancewood
Pseudopanax Lessonii
OTR, 1916.

northern needle-leaved heath
Dracophyllum Urvilleanum
CNZ, 1919.

northern rata
Metrosideros lucida
DDD, 1917.
Metrosideros robusta
RDT, 1875.
KFF, 1889.
MNZ, 1905.
CWK, 1908.
CNZ, 1910.
NC, 1912.
CNZ, 1919.

North Island edelweiss
Leucogenes Leontopodium
CNZ, 1910.
CNZ, 1919.
CCN, 1924.

North Island eyebright
Euphrasia tricolor
CNZ, 1919.

North Island lily
Arthopodium cirratum
MLN, 1890.
NC, 1912.

North Island rata
Metrosideros robusta
LB, 1906.
CKI, 1907.

nutmeg tree
Drimys axillaris
Ver. (WB)

oak
Carpodetus serratus
CCV, 1872.

oak of the Pacific
Virtex lucens
PNZ, 1838.
PMC, 1840.

oak-leaved alseuosmia
Alseuosmia quercifolia
LB, 1906.

oak-leaved goose-foot
Chenopodium glaucum var. *ambiguum*
CSI, 1909.

oak-leaved goosefoot
Chenopodium glaucum var. *ambiguum*
CDA, 1911.

oat-like bent grass
Deyeuxia avenoides
CIG, 1880.

oat-like bent-grass
Deyeuxia avenoides
CTP, 1908.
CSI, 1909.

obcordate-leaved myrtle
Myrtus obcordata
LB, 1906.

obcordatea-leaved pittosporum
Pittosporum obcordatum
LB, 1906.

oblate-berried nertera
Nertera depressa
LB, 1906.

odorous tree-daisy
Olearia ordorata
CNZ, 1919.

Old Man's Eyebrow
Drosera binata
FAA, 1889.

olive-leaved cedar
Agathis australis
CVT, 1771-72.

one-flowered craspedia
Craspedia uniflora
LB, 1906.

one-flowered grass-tree
Dracophyllum uniflorum
LB, 1906.

one-flowered poa
Poa uniflora
CIG, 1880.

one-sided fern
Hymenophyllum peltatum
CSI, 1909.

onion-leaved microtis
Microtis porrifolia
LB, 1906.

onion-leaved orchid
Microtis porrifolia
CKI, 1907.
Microtis unifolia
CTP, 1908.
CWK, 1908.
CSI, 1909.
CDA, 1911.
CKB, 1915.

orange berry
Tetrapathaea australis
Ver. (WB).

orange-coloured swamp-lily
Chrysobactron Rossii
CNZ, 1919.

orange-leaf
Coprosma lucida
HHN, 1867.
LCN, 1868.

orange wood
Nothopanax Edgerleyi
DDD, 1917.

orange-wood
Nothopanax Edgerleyi
DDD, 1917.

pale-blue grass-lily
Herpolirion novaezelandiae
CNZ, 1919.

pale-leaved tree-fern
Hemitilia Smithii
CTP, 1908.

pale-leaved willow-herb
Epilobium chionanthum
CKI, 1907.
CSI, 1909.

pale willow-herb
Epilobium novae-zelandiae
CNZ, 1919.

palm
Rhopalostylis sapida
HHN, 1867.
Trans. 1, 1869.

palm-leaved fern
Blechnum capense
DMs., 1921.

palm lily
Cordyline australis
SLM, 1902.
MNZ, 1905.
CMN, 1906.
LB, 1906.

*palm-lily
Cordyline australis
Trans. 28, 1896.
DCO, 1900.
Trans. 36, 1904.
CWK, 1908.
THW, 1909.
CNZ, 1910.
Cordyline Banksii
MSE, 1888.

palm tree
Cordyline australis
HLN, 1856.

palm-tree
Cordyline australis
PPO, 1868.

pampas grass
Arundo conspicua
BOS, 1900.

paper leaf
Brachyglottis repanda
Ver. (WB)

parasite-myrtle
Metrosideros robusta
DRA, 1872.

parrot-bill
Clianthus puniceus
DRA, 1872.
CNZ, 1919.

parrotbill
Clianthus puniceus
CNZ, 1910.

parrot's beak
Clianthus puniceus
SLM, 1902.
NC, 1912.

parrot's beak fuchsia
Clianthus puniceus
RHH, 1893.

parrot's Bill
Clianthus puniceus
FAA, 1889.

parrot's-bill
Clianthus puniceus
HSL, 1835.
MI, 1884.
Trans. 18, 1886

parsley fern
Botrychium ternatum
DDD, 1917.
Botrychium flabellifolium
DFN, 1921.

parsley-fern
Botrychium ternatum
THW, 1909.

passion flower
Tetrapathaea australis
CSJ, 1846.
MLN, 1890.

passion-flower
Tetrapathaea australis
NZJ, 1848.
TIC, 1906.

patch-plant
Raoulia australis and other *Raoulia*
BN, 1867.

Paterson's fern
Blechnum Patersoni
LFN, 1875.
POO, 1882.
CTP, 1908.
CSI, 1909.

pedunculate myrtle
Myrtus pedunculata
LB, 1906.

pellitory
Parietaria debilis
HHN, 1867.

pendant spleenwort
Asplenium flaccidum
CSI, 1909.

Pendent spleenwort
Asplenium flaccidum
CWK, 1908.
THW, 1909.

pendulous club-moss
Lycopodium Billardieri
CNZ, 1919.

pendulous lycopodium
Lycopodium Billardieri
DDD, 1917.

penny wort
Hydrocotyle elongata
Trans. 1, 1869.

pen-wiper plant
Notothlaspi rosulatum
KSF, 1899.
DCO, 1900.
LB, 1906.

penwiper plant
Notothlaspi rosulatum
CMN, 1906.
CNZ, 1910.

penwiper-plant
Notothlaspi rosulatum
CNZ, 1919.

pepper tree
Wintera (= *Drimys*) *axillaris*
Trans. 2, 1870.
Trans. 3, 1871.
FAA, 1889
VTN, 1896.
LB, 1906.
Wintera (= *Drimys*) *colorata*
Trans. 1, 1869.
Trans. 2, 1870.
Trans. 3, 1871.
MLN, 1890.
NC, 1912.
Macropiper excelsum
TIM, 1855.
PPO, 1868.
Ver. (WB)

pepper-tree
Wintera (= *Drimys*) *axillaris*
TNC, 1856.
Trans. 13, 1881.
KFF, 1889.
MNZ, 1905.
TIC, 1906.
CKI, 1907.
CWK, 1908.
THW, 1909.
CNZ, 1910.
DFC, 1916.
CNZ, 1919.
Wintera (= *Drimys*) *colorata*
MNZ, 1905.
TIC, 1906.
CTP, 1908.
THW, 1909.
CNZ, 1919.
CCN, 1924.

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* ". . . the most appropriate name, 'palm-lily,' for which we are indebted to the learned Baron von Mueller, is sufficiently elegant and euphonious to be generally adopted." Kirk, Trans. 28, p. 509, 1896.

peppertree
Wintera (= *Drimys*) *axillaris*
DFC, 1896.

pepper-wood
Wintera [*Drimys*] *axillaris*
NZJS, 1923.

pepperwort
Lepidium sisymbrioides
Trans. 1, 1869

perching-kahakaha
Astelia Solandri
CNZ, 1919.

perching-kohuhu
Pittosporum cornifolium
CNZ, 1919.
CCN, 1924.

perching-kowharawhara
Astelia Cunninghamii
CNZ, 1919.

perching-lilies
Astelia sp.
CNZ, 1910.

perching lily
Astelia Solandri
CWK, 1908.

perennial flax
Linum monogynum
TNC, 1856.

persicaria-leaved pondweed
Potamogeton polygonifolius
CSI, 1909.

Petrie's coprosma
Coprosma Petriei
CTP, 1908.

Petrie's fireweed
Erechtites diversifolia
CSI, 1909.

Petrie's ourisia
Ourisia prorepens
CSI, 1909.

Petrie's stipa
Stipa Petriei
CIG, 1880.

phylica-leaved pomaderris
Pomaderris phylicaefolia
LB, 1906.

physalis-like colensoa
Colensoa physaloides
LB, 1906.

pigeon wood
Hedycarya arborea
Ver. (Stony Bay)

pigeon-wood
Hedycarya arborea
EM, 1911.

pigeonwood
Hedycarya arborea
CWK, 1908.
CNZ, 1919.
CCN, 1924.
Ver. (WB)

pig-face
Mesembryanthemum
MNZ, 1905.
Mesembryanthemum australe
VN, 1920.

pigmy pine
Dacrydium laxifolium
CTP, 1908.
CSI, 1909.

pig's face
Mesembryanthemum australe
CSI, 1909.

pig's-face
Mesembryanthemum australe
CNZ, 1910.

pigs-face
Mesembryanthemum australe
TNN, 1909.

pigsface
Mesembryanthemum australe
CDA, 1911.

pigs' faces
Mesembryanthemum australe
KSF, 1899.
LB, 1906.

pilose bent grass
Deyeuxia Forsteri var. *pilosa*
CIG, 1880.

pink broom
Carmichaelia odorata
OTR, 1916.
Notospartium Carmichaelia
HHN, 1867.
FAA, 1889.
KSF, 1899.
CMN, 1906.
CNZ, 1910.
CNZ, 1919.
CCN, 1924.

pink-flowered manuka
Leptospermum Chapmanii
DDD, 1917.

pink-flowered mesembryanthemum
Mesembryanthemum australe
TNC, 1856.

pink New Zealand jasmine
Parsonsia capsularis var. *rosea*
CKB, 1915.

pipe wood
Schefflera digitata
Ver. (Stony Bay)

pitch pine
Phyllocladus alpinus
NZCJ, 1892.
Phyllocladus trichomanoides
HNZ, 1857.

pitoko (= titoki)
Alectryon excelsum
RSC, 1844.

plantain
Plantago lanigera
Trans. 1, 1869

plumed maidenhair
Adiantum formosum
POO, 1882.
FFN, 1890.
DFN, 1921.

plumed maiden hair fern
Adiantum formosum
LFN, 1875.

plumed tussac grass
Arundo conspicua
CIG, 1880.

plume grass
Arundo conspicua
MLN, 1890.

plume-grass
Arundo conspicua
Trans. 43, 1911
Dichelachne crinita
NZJS, 1925.

poa-like fescue
Poa litorosa
CIG, 1880.

pointed-leaved beech
Nothofagus apiculata
KFF, 1889.

pointed-leaved earina
Earina mucronata
CWK, 1908.

polar stilbocarpa
Stilbocarpa polaris
LB, 1906.

pond weed
Potamogeton natans
Trans. 1, 1869.

pond-weed
Potamogeton sp.
CNZ, 1919.
Potamogeton natans
TIC, 1906.
CTP, 1908.
CNZ, 1910.

pondweed
Potamogeton sp.
HHN, 1867.

ponja (= ponga)
Cyathea Cunninghamii
MVC, 1864.
HHN, 1867.

poplar-like ribbon-wood
Hoheria papulnea
LB, 1906.

Port Hills groundsel
Senecio saxifragoides
CKB, 1915.

potato plant
Solanum aviculare
HMB, 1898.

prenanthes-like erechtites
Erechtites prenanthoides
LB, 1906.

prickly heath
Leucopagon Fraseri
GST, 1921.

prickly saltwort
Salsola Kali
CNZ, 1919.

prickly sedge
Carex stellulata var. *australis*
CSI, 1909.

prickly shield fern
Polystichum vestitum
POO, 1882.
FFN, 1890.
CTP, 1908.
THW, 1909.

prickly shield-fern
Polystichum vestitum
CSI, 1909.
CKB, 1915.
CNZ, 1919.

prickly styphelia
Cyathodes acérosa
LB, 1906.

*prickly thorn
Discaria toumatou
TCS, 1851.

primrose
Samolus repens var. *procumbens*
Trans. 1, 1869.

Prince of Wales feather
Leptopteris superba
BOS, 1900.
DFN, 1921.
CCN, 1924.
DDD (2), 1925.
Ver. (WB)

Prince of Wales' feather
Leptopteris superba
POO, 1882.
FFN, 1890.

Prince of Wales's feather
Leptopteris superba
CTP, 1908.
CSI, 1909.
THW, 1909.

privet-leaved geniostoma
Geniostoma ligustrifolium
LB, 1906.

proliferous club-rush
Scirpus sulcatus var. *distigmatosa*
CSI, 1909.

proliferous spleenwort
Asplenium bulbiferum
LFN, 1875.

prostrate coprosma
Coprosma depressa
CTP, 1908.

prostrate fuchsia
Fuchsia procumbens
LB, 1906.

prostrate kowhai
Sophora prostrata
CNZ, 1919.

prostrate needle-leaved heath
Dracophyllum rosmarinifolium
CNZ, 1919.

prostrate New Zealand box.
Veronica buxifolia var. *prostrata*
CSI, 1909.

prostrate parsley
Apium prostratum
LB, 1906.

pumice whipcord koromiko
Veronica tetragona
CNZ, 1919.

pungent heath
Leucopogon Fraseri
CNZ, 1919.

pungent mingimingi
Cyathodes acerosa
CNZ, 1919

puredi (= puriri)
Vitex lucens
BGN, 1860.

puridi (= puriri)
Vitex lucens
RSC, 1844.

purple-awned oat grass
Danthonia pilosa
CIG, 1880.

purple-awned oat-grass
Danthonia pilosa
CTP, 1908.
CWK, 1908.
CSI, 1909.
CDA, 1911.
NZJS, 1923.

purple cudweed
Graphalium purpureum
KSF, 1899.

purple-flowered daisy-tree
Olearia angustifolia
CSI, 1909.
CNZ, 1910.

* "There are two plants, the karo (prickly thorn) and taramea (spear grass), which are well worthy of their names, but are almost exclusively confined, that is, the larger varieties, to the hilly regions. There generally grows near these a plant called tikuma (cotton- or leather- plant) from the leaf of which the natives make mats and leggings, which are impervious to the sharp points of the former..." TCS, par. 51.

purple-flowered tree-daisy
Olearia semidentata
CNZ, 1919.

purple tree-daisy
Olearia semidentata
CNZ, 1919.

purua-grass
Scirpus maritimus
Ver. (A).

pygmy bolbophyllum
Bolbophyllum pygmaea
LB, 1906.

pygmy drosera
Drosera pygmaea
LB, 1906.

pygmy pine
Dacrydium laxifolium
CNZ, 1919.
CCN, 1924.

Pyrenees sedge
Carex pyrenaica
CTP, 1908.

quillwort
Isoetes Kirkii
CNZ, 1910.

racemed oat grass
Danthonia pilosa
CIG, 1880.

racemose aristotelia
Aristotelia racemosa
LB, 1906.

racemose weinmannia
Weinmannia racemosa
LB, 1906.

Ralph's pittosporum
Pittosporum Ralphii
LB, 1906.

Raoul's plantain
Plantago Raoulii
CSI, 1909.

rare boss fern
Dryopteris unitum
POO, 1882.

raspberry
Rubus australis
TIM, 1855.

rata vine
Metrosideros florida
EM, 1911.
DDD, 1917.
Ver. (WB)

rata-vine
Metrosideros sp.
Trans. 43, 1911.

rat-tail spleenwort
Asplenium flabellifolium
VN, 1920.

rattar (= rata)
Metrosideros robusta
RSC, 1844.

rattle-snake fern
Botrychium ternatum
FFN, 1890.

rattlesnake fern
Botrychium ternatum
FFN, 1890.

red azolla
Azolla rubra
CSI, 1909.

red beech
Nothofagus fusca
CNZ, 1910.
OTR, 1916.
DDD, 1917.

red-beech
Nothofagus fusca
JM, 1909.
THW, 1909.
Trans. 42, 1910.

red berry
Coprosma robusta
Ver. (WB).

red biddy-bid
Acaena novae-zealandiae
CKB, 1915.

red birch
Nothofagus fusca
Trans. 1, 1869.
Trans. 17, 1885.
HRN, 1889.
KFF, 1889.
CMN, 1906.
Ver. (WB).
Nothofagus Menziesii
HHN, 1867.
CCV, 1872.
Trans. 17, 1885.
CMN, 1906.
Nothofagus Solanderi
Trans. 17, 1885.
KFF, 1889.
Rapanea Urvillei
KFF, 1889.
OTR, 1916.
Weinmannia racemosa
Trans. 9, 1877.
KFF, 1889.

red-birch
Nothofagus fusca
MNZ, 1905.
Rapanea Urvillei
THW, 1909.

red-birch
Weinmannia racemosa
CNZ, 1919.

red-blotched horopito
Wintera (= *Drimys*) *colorata*
CKB, 1915.

red climbing-rata
Metrosideros florida
CNZ, 1919.

reddish filmy fern
Hymenophyllum rufescens
CSI, 1909.

red fescue
Festuca rubra
NZJS, 1923.

red-flowered manuka
Leptospermum Chapmanii
DDD, 1917.

red-fruited coprosma
Coprosma rhamnoides
CKI, 1907.
CSI, 1909.
CKB, 1915.

red-fruited gunnera
Gunnera dentata
CTP, 1908.

red-fruited maire
Eugenia maire
CWK, 1908.

red heath
Dracophyllum recurvum
CNZ, 1919.

red horopito
Wintera (= *Drimys*) *colorata*
THW, 1909.

red kamai
Nothofagus fusca
Trans. 9, 1877.

red kowhai
Clianthus puniceus
CCN, 1924.

red manuka
Leptospermum scoparium
Trans. 9, 1877.

red-manuka
Leptospermum ericoides
MNZ, 1905.

red mapau
Rapanea Urvillei
CCV, 1872.
RDT, 1875.
Trans. 9, 1877.
TIC, 1906.
CSI, 1909.
DFC, 1916.

red maple
Rapanea Urvillei
CSI, 1909.
red-maple
Rapanea Urvillei
CKB, 1915.

red matipo
Rapanea Urvillei
NZCJ, 1878.
DCO, 1900.
CKI, 1907.
CSI, 1909.

red mistletoe
Elytranthe tetrapetata
CNZ, 1919.

red New Zealand burr
Acaena novae-zealandiae
CSI, 1909.
CDA, 1911.

red parrot's bill
Clianthus puniceus
HNZ, 1857.

red pine
Dacrydium cupressinum
NZJ, 1849.
STT, 1850.
HNZ, 1857.
HHN, 1867.
PPO, 1868.
Trans. 1, 1869.
CCV, 1872.
MSE, 1888.
KFF, 1889.
CMN, 1906.
LB, 1906.
Podocarpus spicatus
HCE, 1844.
Trans. 1, 1869.
KFF, 1889.
Podocarpus totara
PNZ, 1838.
PMC, 1840.

red-pine
Dacrydium cupressinum
MNZ, 1905.
TIC, 1906.
CWK, 1908.
THW, 1909.
NZJS, 1924.

red piripiri
Acaena novae-zealandiae
KSF, 1899.
CSI, 1909.
CDA, 1911.

red rush
Leptocarpus simplex
CSI, 1909.

red-seeded broom
Carmichaelia australis
CDA, 1911.

red southern-beech
Nothofagus fusca
CNZ, 1919.
CCN, 1924.

red-stemmed willow-herb
Epilobium billardierianum
CKI, 1907.
CSI, 1909.
CDA, 1911.

red tea-tree
Leptospermum scoparium
CTP, 1908.
CNZ, 1910.
CNZ, 1919.

red tree rata
Metrosideros robusta
OTR, 1916.

red tussock
Danthonia Raoulii
CSI, 1909.

red-tussock
Danthonia Raoulii var. *rubra*
CTP, 1908.
THW, 1909.
CNZ, 1919.

red uncinia
Uncinia rubra
CTP, 1908.

reedmace
Typha angustifolia
HHN, 1867.

remarkable olearia
Olearia insignis
LB, 1906.

renga lily
Arthropodium cirratum
Trans. 34, 1902.

retuse coprosma
Coprosma retusca
CSI, 1909.

ribbon-scrub
Plagianthus Lyallii
Trans. 3, 1871.

ribbon tree
Gaya Lyallii
NC, 1912.
Plagianthus betulinus
FAA, 1889.

ribbon-tree
Plagianthus betulinus
HHN, 1867.

ribbon wood
Hoheria populnea
Trans. 2, 1870.
SLM, 1902.
Plagianthus betulinus
DFC, 1896.
Plagianthus Lyallii
FAA, 1889.

ribbon-wood
Hoheria populnea
HHN, 1867.
Trans. 1, 1869.
Trans. 9, 1877.
FAA, 1889.
MLN, 1890.
CMN, 1906.
Pennantia corymbosa
Trans. 1, 1869.
Trans. 9, 1877.
Plagianthus betulinus
Trans. 1, 1869.
Trans. 9, 1877.
KSF, 1899.
TIC, 1906.
TNN, 1909.
DFC, 1916.

ribbonwood
Hoheria populnea
NC, 1912.
HEC, 1915.
Pennantia corymbosa
CCV, 1872.
Plagianthus betulinus
CCV, 1872.
Trans. 12, 1880.
KFF, 1889.
MNZ, 1905.
CMN, 1906.
TIC, 1906.
TNN, 1909.

Richards' shield fern
Polystichum Richardi
POO, 1882.

Richard's spleenwort
Asplenium Richardi
CTP, 1908.

Richards' spleenwort
Asplenium Richardi
POO, 1882.

river daisy
Graphalium keriense
DDD (2), 1925.

river river (= rewa-rewa)
Knightia excelsa
NNV, 1817.

robust coprosma
Coprosma robusta
LB, 1906.

rock-akeake
Olearia Forsteri
CNZ, 1919.

rock-anisotome
Anisotome Enysii
CNZ, 1919.

rock-bluebell
Wahlenbergia cartilaginea
CNZ, 1919.

rock cotton-plant
Celmisia Monroi
CNZ, 1919.

rock-cudweed
Gnaphalium Lyallii
CNZ, 1919.

rock-fern
Adiantum aethiopicum
VN, 1920.
Cheilanthes Sieberi
DMs., 1921.

rock forget-me-not
Myosotis saxatilis
CNZ, 1919.

rock-koromiko
Veronica annulata and others
CNZ, 1919.

rock lily
Arthropodium cirratum
OTR, 1916.
DDD, 1917.
DDD (2), 1925.

rock-lily
Arthropodium cirratum
CNZ, 1919.
CCN, 1924.
NZJS, 1924.
NZJS, 1925.

rock shrub-groundsel
Senecio Monroi
CNZ, 1919.

rock sow-thistle
Sonchus littoralis
CKI, 1907.

rock spleenwort
Asplenium trichomanes
POO, 1882.

rock tree-daisy
Olearia insignis
CNZ, 1919.

*Rockwood lily
Ranunculus Lyallii
POO, 1882.

rolling-grass
Spinifex hirsutus
CNZ, 1910.

rooting selliera
Selliera radicans
LB, 1906.

rose-leaved anise
Angelica rosaefolia
CNZ, 1919.

rose-leaved lawyer
Rubus schmidelioides
CWK, 1908.

rosette-like notothlaspi
Notothlaspi rosulatum
LB, 1906.

rosette plant
Notothlaspi rosulatum
NZCJ, 1892.

Ross's bulbinella
Bulbinella Rossii
LB, 1906.

rosy New Zealand jasmine
Parsonsia capsularis
CWK, 1908.

rough-bearded grass
Echinopogon ovatus
CIG, 1880.
NZJS, 1923.

rough bracken
Paesia scaberula
POO, 1882.
CWK, 1908.
CNZ, 1919.

Rough's chickweed
Stellaria Roughii
LB, 1906.

rough Spaniard
Aciphylla squarrosa
LB, 1906.

rough-stalked filmy fern
Hymenophyllum scabrum
POO, 1882.
CWK, 1908.

rough tree-fern
Dicksonia squarrosa
FFN, 1890.
DFC, 1916.

round-leaved beech
Nothofagus Menziesii
RDT, 1875.

round-leaved climbing rata
Metrosideros scandens
CWK, 1908.

round-leaved coprosma
Coprosma rotundifolia
LB, 1906.
CSI, 1909.
THW, 1909.
CKB, 1915.
CNZ, 1919.

round-leaved fern
Pellaea rotundifolia
POO, 1882.
CKB, 1915.

round-leaved shrubby groundsel
Senecio rotunifolius
CSI, 1909.
CNZ, 1910.

round-leaved spider-orchid
Corysanthes rotundifolia
CSI, 1909.

round-leaved willow-herb
Epilobium rotundifolium
CKI, 1907.
CWK, 1908.
CKB, 1915.

royal fern
Leptopteris superba
POO, 1882.

rue-leaved fern
Gymnogramme rutaefolia
POO, 1882.
CKB, 1915.

*Probably through being found on the Rockwood run in the Malvern Hills, Canterbury. See POO, p. 76.

rum-a-rum (= rama-rama)
Myrtus bullata
Ver. (WB)

ruscus-leaved coriaria
Coriaria sarmentosa
LB, 1906.

rush
Juncus sp.
HHN, 1867.
THW, 1909.
CNZ, 1910.

rushes (Ra-poo)
Typha angustifolia
ENZ, 1832.

rush fern
Schizaea fistulosa
POO, 1882.

rush-fern
Schizaea fistulosa
CSI, 1909.

rusty filmy fern
Hymenophyllum ferrugineum
POO, 1882.
CWK, 1908.

rusty podocarpus
Podocarpus ferrugineus
LB, 1906.

ruva-ruva (= rewa-rewa)
Knightia excelsa
HNR, 1842.

sacred-fern
Doodia caudata
FFN, 1890.

*sacrie
Stilbocarpa polaris

St. John's wort
Hypericum gramineum
Trans. 1, 1869.
Trans. 2, 1870.

Selago-like everlasting
Helichrysum selago
LB, 1906.

salicornia-like mistletoe
Viscum salicornia
LB, 1906.

salt-grass
Atropis stricta
CNZ, 1919.

salt-marsh bulrush
Scirpus robustus
CKI, 1907.

salt-marsh ribbonwood
Plagianthus divaricatus
CSI, 1909.

salt-marsh sand-spurrey
Spergularia media
CKI, 1907.
CSI, 1909.

salt-marsh sedge
Carex litorosa
CSI, 1909.

salt-meadow cotula
Cotula dioica
CDA, 1911.

samphire
Salicornia australis
Trans. 23, 1891.

samphire-leaved ranunculus
Ranunculus crithmifolius
LB, 1906.

sandal-wood
Fusanus Cunninghamii
?

sandalwood
Olearia Traversii
MLN, 1890.
NC, 1912.

sand bent-grass
Calamagrostis billardieri
CSI, 1909.

sand bindweed
Calystegia Soldanella
CKI, 1907.

sand-convolvulus
Calystegia Soldanella
CNZ, 1919.

sand-coprosma
Coprosma acerosa
CNZ, 1910.
CDA, 1911.
CNZ, 1919.

sand-fescue
Festuca littoralis
CDA, 1911.

sand fescue-grass
Festuca littoralis
CDA, 1911.

sand-grass
Scirpus frondosus
CDA, 1911.

sand-gunnera
Gunnera arenaria
CSI, 1909.
CDA, 1911.
CNZ, 1919.

sandhill-fescue
Festuca littoralis
CSI, 1909.

sandhill fescue grass
Festuca littoralis
CIG, 1880.

sand-pimelea
Pimelea arenaria
CDA, 1911.

sand-sedge
Carex pumila
CDA, 1911.
CNZ, 1919.

sand tussock-grass
Festuca littoralis
CDA, 1911.

savage lancewood
Pseudopanax ferox
LB, 1906.

savory palm-tree
Rhopalostylis sapida
DRA, 1872.

saw-edge polypody
Polypodium grammitidis
POO, 1882.
CTP, 1908.

saw-leaved Spaniard
Aciphylla Lyallii var. *crenulata*
NZCJ, 1879.

scabrid fireweed
Erechtites scaberula
CSI, 1909.

scab-weed
Raoulia lutescens
AJ,

scarce bracken
Pteris comans
POO, 1882.

scarlet clianthus
Clianthus puniceus
LB, 1906.

scarlet climbing-rata
Metrosideros florida
CNZ, 1919.

scarlet-flowered mistletoe
Loranthus Colensoi
TNN, 1909.

*The name given to the root by the ship-wrecked crew of the Dundonald on Auckland Islands. They ate the root as a vegetable.

scarlet mistletoe
Elyranthe tetrapetala
CTP, 1908.
THW, 1909.
Loranthus Colensoi
HNF, 1888.
HRN, 1889.
THW, 1909.
TNN, 1909.

scented broom
Carmichaelia odorata
WDJ, 1850.
FAA, 1889.

scented doodia
Doodia caudata
POO, 1882.

scented fern
Paesia scaberula
DFN, 1921.
Pteris tremula
FFN, 1890.

scented-fern
Pteris tremula
FFN, 1890.

scented filmy fern
Hymenophyllum sanguinolentum
POO, 1882.
CTP, 1908.
CSI, 1909.
Hymenophyllum polyanthos
POO, 1882.

scented grass
Hierochloe redolens
NZCJ, 1879.
POO, 1882.
GST, 1921.

scented polypody
Dryopteris pustulatum
POO, 1882.
CWK, 1908.

scented sundew
Drosera binata
SPR, 1909.

Schmidelia-like bramble
Rubus schmidelioides
LB, 1906.

scoop-leaved koromiko
?Veronica haustrata
NZCJ, 1879.

scoria-koromiko
Veronica spathulata
CNZ, 1919.

scrambling umbrella fern
Gleichenia circinata
CWK, 1908.

scrambling umbrella-fern
Gleichenia circinata
CSI, 1909.

scrub manuka
Leptospermum ericoides
Ver. (WB)

scurvy weed
Lepidium oleraceum
FAA, 1889.

sea-blite
Suaeda maritima
CNZ, 1919.

sea club-rush
Scirpus robustus
CNZ, 1919.

sea-grass
Zostera nana
CNZ, 1919.
Zostera tasmanica
CNZ, 1919.

sea-rush
Juncus maritimus var. *australiensis*
CNZ, 1919.

sea-sedge
Carex litorosa
CNZ, 1919.

sea-shore dock
Rumex neglectus
CSI, 1909.
CDA, 1911.

seashore poa
Poa Astoni
CSI, 1909.

sea-side brome grass
Bromus arenarius
CIG, 1880.

seaside brome-grass
Bromus arenarius
CDA, 1911.

sea-side millet
Paspalum distichum
CIG, 1880.

sea-side samolus
Samolus littoralis
LB, 1906.

sea spleenwort
Asplenium obtusatum
CKB, 1915.

sea-spleenwort
Asplenium obtusatum
CNZ, 1910.

sea-wrack
Zostera nana
TIC, 1906.
DFC, 1916.

sedge
Carex Darwini var. *urolepsis*
Carex trifida
Gahnia xanthocarpa
CNZ, 1910.

selago-like everlasting
Helichrysum Selago
LB, 1906.

semi leafless lawyer
Rubus subpauperatus
CNZ, 1919.

semi-whipcord koromiko
Veronica tetrasticha
CNZ, 1919.

serrate carpodetus
Carpodetus serratus
LB, 1906.

serrated quintinia
Quintinia serrata
LB, 1906.

sharp-leaved creeping astelia
Astelia subulata
CSI, 1909.

sharp-leaved heath
Cyathodes acerosa
CTP, 1908.
CKB, 1915.
Leucopogon Fraseri
CNZ, 1919.

sharp-leaved totara
Totara acutifolius
CNZ, 1919.

sharp-pointed earina
Earina mucronata
LB, 1906.

sharp-toothed filmy fern
Hymenophyllum multifidum
POO, 1882.
CTP, 1908.

sharp-toothed marsh-pennywort
Hydrocotyle moschata
CKB, 1915.

sheep oat grass
Danthonia semiannularis
CIG, 1880.

shepherd's basket fungus
Clathrus cibarius
GST, 1921.

shepherd's lily
Ranunculus Lyallii
FAA, 1889.
KSF, 1899.
MLN, 1890.

shield fern
Polystichum
DFN, 1921.

shining broadleaf
Griselinia lucida
LB, 1906.

shining coprosma
Coprosma lucida
CSI, 1909.

shining oat grass
Trisetum antarcticum
CIG, 1880.

shining oat-grass
Trisetum antarcticum
CTP, 1908.
CSI, 1909.
CKB, 1915.

shining olearia
Olearia arborescens
LB, 1906.

shining rata
Metrosideros lucida
LB, 1906.

shining sedge
Carex lucida
CKI, 1907.
CDA, 1911.

shining spleenwort
Asplenium lucidum
CWK, 1908.
THW, 1909.

shining-spleenwort
Asplenium adiantoides
CNZ, 1919.
Asplenium lucidum
DMs., 1921.

***shittim wood**
Nothopanax arboreum
Ver. (Stony Bay)

shore-buttercup
Ranunculus acaulis
CKI, 1907.
CSI, 1909.
CDA, 1911.
CNZ, 1919.

shore convolvulus
Calystegia Soldanella
CNZ, 1910.
Trans. 46, 1914.

shore-convolvulus
Calystegia Soldanella
CDA, 1911.

shore-cotula
Cotula dioica
CNZ, 1919.

shore-cress
Lepidium tenuicaule
CSI, 1909.
CNZ, 1919.

shore-dock
Rumex neglectus
CDA, 1911.
CNZ, 1919.

shore-eyebright
Euphrasia repens
CNZ, 1919.

shore forget-me-not
Myosotis albida
CNZ, 1919.

shore-fuchsia
Fuchsia procumbens
CNZ, 1919.

shore-gentian
Gentiana saxosa
CNZ, 1919.

shore-groundsel
Senecio lautus
CNZ, 1919.

shore hard-fern
Blechnum Banksii
CNZ, 1919.

shore-koromiko
Veronica elliptica
CNZ, 1919.

shore-kawharawhara
Astelia Banksii
CNZ, 1919.

shore-lobelia
Lobelia anceps
CNZ, 1919.

shore-panax
Pseudopanax Lessonii
CNZ, 1919.

shore spleenwort
Asplenium obtusatum
POO, 1882.
CSI, 1909.

shore-spleenwort
Asplenium obtusatum
CNZ, 1919.

shore stonecrop
Crassula moschata
CSI, 1909.

shore-stonecrop
Crassula moschata
CNZ, 1919.

short-awned wheat grass
Agropyron multiflorum
CIG, 1880.

short-flowered celmisia
Celmisia sessiliflora
CSI, 1909.

short-flowered crane's-bill
Geranium sessiliflorum var. *glabrum*
CKI, 190-.

short-flowered cranesbill
Geranium sessiliflorum var. *glabrum*
CSI, 1909.
CDA, 1911.
CNZ, 1919.

short-flowered meadow grass
Poa foliosa
NZCJ, 1879.

short-glumed poa
Poa breviglumis
CIG, 1880.

short-hair plume grass
Dichelachne sciurea
CIG, 1880.

short-stemmed willow-herb
Epilobium nerterioides var. *minimum*
CSI, 1909.

shrubby aristotelia
Aristotelia fruticosa
LB, 1906.

shrubby entelea
Entelea arborescens
LB, 1906.

shrubby forest-groundsel
Senecio Kirkii
CNZ, 1910.

shrubby fuchsia
Fuchsia Colensoi
CSI, 1909.
CKB, 1915.

shrubby groundsel
Senecio perdicioides
CNZ, 1910.
CNZ, 1919.

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*A euphemism; so named on account of the smell of the decaying wood.

shrubby honeysuckle
Alseuosmia macrophylla
CNZ, 1919.

shrubby nettle
Urtica ferox
Trans. 37, 1905.
CNZ, 1919.

shrubby panax
Nothopanax anomalum
CKI, 1907.
CSI, 1909.
THW, 1909.

shrubby pittosporum
Pittosporum rigidum
CTP, 1908.

shrubby pohuehue
Muehlenbeckia Astoni
CNZ, 1919.

shrubby ribbonwood
Plagianthus divaricatus
CNZ, 1910.
CNZ, 1919.
CCN, 1924

shrubby speedwell
Veronica diosmaefolia
CNZ, 1910.

shrub-fuchsia
Fuchsia Colensoi
CNZ, 1919.

shrub-groundsel
Senecio
CCN, 1924.

shrub rata
Metrosideros lucida
NZCJ, 1888.

Sieber's fern
Cheilanthes Sieberi
POO, 1882.
CKB, 1915.

silky alpine buttercup
Ranunculus sericophyllus
CNZ, 1919.

silver akeake
Olearia Traversii
MNZ, 1905.
DDD, 1917.
DDD (2), 1925.

silverback
Corysanthes macrantha
LB, 1906.

silver beech
Nothofagus Menziesii
Trans. 17, 1885.
KFF, 1889.
CNZ, 1910.

silver-beech
Nothofagus Menziesii.
CTP, 1908.
THW, 1909.

silver birch
Nothofagus Menziesii
KFF, 1889.
CMN, 1906.
Ver. (WB)
Pittosporum tenuifolium
Ver. (WB)

silver-birch
Nothofagus Solanderi
MNZ, 1905.

silver cushion-celmisia
Celmisia argentea
CNZ, 1919.

silver filmy fern
Hymenophyllum Malingii
THW, 1909.

silver-green fern
Loxsoma Cunninghamii
DMs., 1921.

silver king
(silver-king in Ms.)
Cyathea dealbata
DFN, 1921.

silver matipo
Pittosporum tenuifolium var. *variegata*
DDD, 1917.

silver pine
Dacrydium Colensoi
Trans. 9, 1877.
KFF, 1889.
MNZ, 1905.
CMN, 1906.
DFC, 1916.
Ver. (WB)
Libocedrus Bidwillii
HEC, 1915.

silver-pine
Dacrydium Colensoi
CTP, 1908.
CWK, 1908.
THW, 1909.
CCN, 1924.

silver piripiri
‡*Acaena adcendens*
DDD (2), 1925.

silver ponga
Cyathea dealbata
DDD (2), 1925.

silver southern-beech
Nothofagus Menziesii
CNZ, 1919.
CCN, 1924.

silver tree fern
Cyathea dealbata
LFN, 1875.
HMB, 1898.
CMN, 1906.
DFC, 1916.
OTR, 1916.
DDD, 1917.

silver tree-fern
Cyathea dealbata
POO, 1882.
TFF, 1882.
FFN, 1890.
CWK, 1908.
THW, 1909.
CNZ, 1910.
CKB, 1915.
CNZ, 1919.
CCN, 1924.

silver-tussock
Poa caespitosa
CKB, 1915.
CNZ, 1919.
NZJS, 1923.

silver-weed
Potentilla anserina
KSF, 1899.

silverweed
Potentilla anserina var. *anserinoides*
DFC, 1896.
CSI, 1909.
DFC, 1916.

silvery celmisia
Celmisia argentea
CSI, 1909.
CNZ, 1919.

silvery cotton-plant
Celmisia coriacea
CNZ, 1919.

silvery cushion-celmisia
Celmisia argentea
CNZ, 1919.

silvery filmy fern
Hymenophyllum Malingii
CTP, 1908.

‡ Evidently an error as this plant is not found nearer than Macquarie Island; the name should probably be *Acaena saccaticupula.*

silvery raoulia
Raoulia australis
CTP, 1908.
CDA, 1911.

silvery sand-grass
Spinifex hirsutus
CDA, 1911.
CNZ, 1919.

silvery tree-fern
Cyathea dealbata
MSE, 1888.

silvery mountain-daisy
Celmisia argentea
CSI, 1909.

simple bur-reed
Sparganium subglobosum
HHN, 1867.

simple-leaved melicope
Melicope simplex
LB, 1906.

simple-leaved nothopanax
Nothopanax simplex
LB, 1906.

simple-leaved panax
Nothopanax simplex
CTP, 1908.

Sinclair's celmisia
Celmisia Sinclairii
CSI, 1909.

Sinclair's brachycome
Brachycome Sinclairii
LB, 1906.

Sinclair's calceolaria
Jovellana Sinclairii
LB, 1906.

Sinclair's panax
Nothopanax Sinclairii
CTP, 1908.

single crape fern
Leptopteris hymenophylloides
CTP, 1908.
CWK, 1908.

single crape-fern
Leptopteris hymenophylloides
CSI, 1909.
THW, 1909.
CKB, 1915.
CNZ, 1919.

single crepe fern
Leptopteris hymenophylloides
DDD (2), 1925.

single Prince of Wales feather
Leptopteris hymenophylloides
DDD, 1917.

six-sepaled clematis
Clematis hexasepata
LB, 1906.

slender alpine buttercup
Ranunculus gracilipes
CSI, 1909.

slender bent grass
Agrostis parviflora
CIG, 1880.

slender blue-bell
Wahlenbergia gracilis
CSI, 1909.
CDA, 1911.
CKB, 1915.
CNZ, 1919.

slender bluebell
Wahlenbergia gracilis
CNZ, 1919.

slender bracken
Paesia scaberula
LFN, 1875.

slender broom
Carmichaelia flagelliformis
CNZ, 1919.

slender cabbage-tree
Cordyline Banksii
CWK, 1908.

slender celery
apium filiforme
CSI, 1909.
CDA, 1911.

slender climbing white rata
Metrosideros hypericifolia
CWK, 1908.

slender climbing white-rata
Metrosideros hypericifolia
CKB, 1915.

slender comb fern
Schizaea fistulosa
POO, 1882.

slender comb-fern
Schizaea fistulosa
CSI, 1909.

slender coprosma
Coprosma tenuicaulis
CWK, 1908.

slender cranesbill
Geranium microphyllum
CKB, 1915.

slender daisy-tree
Olearia virgata var. *lineata*
CSI, 1909.

slender dicksonia
Dicksonia squarrosa
POO, 1882.

slender everlasting
Helichrysum filicaule
CNZ, 1919.

slender-flowered eyebright
Siphonidium longiflorum
CNZ, 1919.

slender fuchsia
Fuchsia Colensoi
CKB, 1915.

slender geranium
Geranium microphyllum
CWK, 1908.

slender glumeless grass
Asperella gracilis
CIG, 1880.
CSI, 1909.

slender muehlenbeckia
Muehlenbeckia complexa
CWK, 1908.

slender native broom
Carmichaelia flagelliformis
CTP, 1908.

slender New Zealand broom
Carmichaelia flagelliformis
CDA, 1911.

slender New Zealand celery
Apium filiforme
CNZ, 1919.

slender New Zealand daisy
Lagenophora petiolata
CSI, 1909.
CKB, 1915.
Lagenophora pumila
CNZ, 1919.

slender panic-grass
Oplismenus undulatifolius
CWK, 1908.

slender panick grass
Oplismenus undulatifolius
CIG, 1880.
slender poa
Poa anceps var. *debilis*
CIG, 1880.
Poa pusilla
CSI, 1909.
slender rush
Juncus pauciflorus
CKB, 1915.
slender sedge
Carex testacea
CSI, 1909.
CDA, 1911.
slender spike-rush
Eleocharis Cunninghamii
CSI, 1909.
slender tree-fern
Dicksonia squarrosa
FFN, 1890.
CWK, 1908.
THW, 1909.
CKB, 1915.
CNZ, 1919.
slender uncinia
Uncinia filiformis
CSI, 1909.
slender violet
Viola filicaulis
CTP, 1908.
slime-fungi
Myxomycetes
CNZ, 1919.
small bog-grass
Microlaena Thomsoni
CSI, 1909.
small bramble
Rubus parvus
LB, 1906.
small craspedia
Craspedia minor
CNZ, 1919.
smaller bindweed
Calystegia tuguriorum
LB, 1906.
smaller grass-tree
Dracophyllum Urvilleanum
CSI, 1909.
smaller swamp-sedge
Carex virgata
CKI, 1907.
smaller white clematis
Clematis hexasepala
CKI, 1907.
CWK, 1908.
small eyebright
Euphrasia zealandica
CNZ, 1919.
small-flowered bent-grass
Agrostis parviflora
NZJS, 1923.
small-flowered chickweed
Stellaria parviflora
CKI, 1907.
CTP, 1908.
CKB, 1915.
small-flowered coprosma
Coprosma parviflora
LB, 1906.
CSI, 1909.
small-flowered forget-me-not
Myosotis pygmaea var. *Traillii*
CKI, 1907.
CSI, 1909.
CDA, 1911.
small-flowered mistletoe
Loranthus micranthus
LB, 1906.
small-flowered New Zealand jasmine
Parsonsia capsularis
CNZ, 1919.
small-flowered oat tussac grass
Danthonia Cunninghamii
CIG, 1880.
small-fruited coprosma
Coprosma microcarpa
CTP, 1908.
small ground tutu
Coriaria thymifolia
FAA, 1889.
small-leafed cress
Nasturtium palustre
TIM, 1855.
small-leafed manuka
Leptospermum ericoides
?
small-leaved acaena
Acaena microphylla
LB, 1906.
small-leaved climbing rata
Metrosideros scandens
?
small-leaved coprosma
Coprosma parviflora
CTP, 1908.
small-leaved crane's-bill
Geranium microphyllum
CKI, 1907.
small-leaved cranesbill
Geranium microphyllum
CSI, 1909.
THW, 1909.
CNZ, 1919.
small-leaved kohuhu
Pittosporum obcordatum
CNZ, 1919.
small-leaved kowhai
Sophora microphylla
CNZ, 1910.
small-leaved lindsaya
**Lindsaya microphylla*
POO, 1882.
DMs., 1921.
small-leaved maiden-hair
Adiantum aethiopicum
POO, 1882.
small-leaved marsh-pennywort
Hydrocotyle microphylla
small-leaved myrtle
Myrtus pedunculata
CTP, 1908.
CNZ, 1919.
small-leaved panax
Nothopanax parvum
CSI, 1909.
small-leaved pohutukawa
Metrosideros villosa
KFF, 1889.
small-leaved ramarama
Myrtus Ralphii
KFF, 1889.
small-leaved tarata
Pittosporum tenuifolium
RDT, 1875.

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* Potts has both *Lindsaya microphylla* and *Lindsay viridis*, the latter being called green lindsaya.

small-leaved tree-daisy
Olearia nummularifolia
CNZ, 1919.

small mountain club-moss
Lycopodium fastigiatum
CNZ, 1919.

small New Zealand gentian
Gentiana Griesbachii
CTP, 1908.
THW, 1909.

small sea-holly
Eryngium vesiculosum
CNZ, 1919.

small sharp-leaved heath
Leucopogon Fraseri
CNZ, 1919.

small swamp-sedge
Carex virgata
CTP, 1908.

small tussac poa
Poa Colensoi var. *intermedia*
CIG, 1880.

small vegetable-sheep
Raoulia bryoides
CNZ, 1919.

small water-milfoil
Myriophyllum Votschii
CNZ, 1919.

small white clematis
Clematis hexasepala
CNZ, 1919.

Smith's tree-fern
Hemitelia Smithii
POO, 1882.

smooth boss fern
Dryopteris glabella
POO, 1882.

smooth boss-fern
Dryopteris glabella
CKB, 1915.

smooth corynocarpus
Corynocarpus laevigata
LB, 1906.

smooth-leaved koromiko
Veronica leiophylla
CNZ, 1919.

smooth pimelea
Pimelea laevigata
LB, 1906.

smut wood
Pennantia corymbosa
Ver. (Stony Bay)

snotty gob
Schefflera digitata
Ver. (Otago)

snow berry
Gaultheria antipoda
HNF, 1888.
Gaultheria rupestris
NC, 1912.

snow-berry
Gaultheria antipoda
LB, 1906.

snowberry
Enargea parviflora
CTP, 1908.
CSI, 1909.
Gaultheria antipoda
MHG, 1885.
DFC, 1896.
TIC, 1906.
CTP, 1908.
TNN, 1909.
THW, 1909.
DFC, 1916.
CNZ, 1919.
Gaultheria rupestris
MLN, 1890.

snow-celmisia
Celmisia viscosa
CNZ, 1919.

snow-gentian
Gentiana corymbifera
CNZ, 1919.

snow grass
Danthonia flavescens
HGC, 1865.
PPO, 1868.

snow-grass
Danthonia Raoullii
CMN, 1906.
CTP, 1908.
CSI, 1909.
NZJS, 1923.

snowgrass
Danthonia Raoullii
THW, 1909.

snow-groundsel
Senecio scorzoneroides
CNZ, 1919.

snow shield fern
Polystichum cystostegium
POO, 1882.

*snow-tree
Carpodetus serratus
HNF, 1888.

snowy eye-bright
Euphrasia repens
CSI, 1909.

snowy mountain-fox-glove
Ourisia macrocarpa
CNZ, 1919.

snowy veronica
Veronica spathulata
CTP, 1908.

soft boss fern
Dryopteris molle
POO, 1882.

soft buckler-fern
Dryopteris molle
DMs., 1921.

soft-leaved coprosma
Coprosma tenuifolia
THW, 1909.

soft-leaved tree-fern
Hemitilia Smithii
THW, 1909.

soft-leaved willow-herb
Epilobium pubens
CKI, 1907.
CSI, 1909.
CKB, 1915.

soft tree fern
Hemitilia Smithii
FFN, 1890.
OTR, 1916.
DDD (2), 1925.

soft tree-fern
Hemitilia Smithii
FFN, 1890.

Solander's beech
Nothofagus Solanderi
LB, 1906.

Solander's orthoceras
Orthoceras Solandri
LB, 1906.

Solander's rhabdothamnus
Rhabdothamnus Solandri
LB, 1906.

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* "So-called from the quantities of little white flowers making it appear as if there had been a fall of snow."

Solander's sedge
Carex Solandri
CSI, 1909.

soldanella-like calystegia
Calystegia soldanella
LB, 1906.

solitary gunnera
Gunnera monoica
LB, 1906.

sorrelwood
Oxalis magellanica
HHN, 1867.

southern arrow-grass
Triglochin striata var. *filifolia*
CKI, 1907.

southern bramble
Rubus australis
LB, 1906.

southern carmichaelia
Carmichaelia australis
LB, 1906.

southern dicksonia
Dicksonia antarctica
POO, 1882.

southern glasswort
Salicornia australis
CKI, 1907.

southern hair-grass
Deschampsia Chapmanni
CSI, 1909.

southern ironback
Metrosideros lucida
RDT, 1875.

Southern Island rata
Metrosideros lucida
MLN, 1890.

Southern Islands poa
Poa foliosa
CSI, 1909.

southern mesembryanthemum
Mesembryanthemum australe
LB, 1906.

southern palm
Rhopalostylis sapida
Trans. 4, 1872.

southern rata
Metrosideros lucida
FAA, 1889.
KFF, 1889.
KSF, 1899.
SLM, 1902.
MNZ, 1905.
CSI, 1909.
CNZ, 1910.
NC, 1912.
CNZ, 1919.
DDD (2), 1925.

southern salsola
Salsola australis
LB, 1906.

southern sicyos
Sicyos australis
LB, 1906.

southern vittadinia
Vittadinia australis
LB, 1906.

southern water-pimpernel
Samolus repens var. *procumbens*
CSI, 1909.
CDA, 1911.
CNZ, 1919.

southern water starwort
Callitriche Muelleri
CSI, 1909.

South Island edelweiss
Leucogenes grandiceps
CCN, 1924.

South Island gahnia
Gahnia procera
CSI, 1909.

South Island ribbon wood
Plagianthus betulinus
HMB, 1898.

Southland gunnera
Gunnera Hamiltonii
CSI, 1909.

sow-thistle
Sonchus asper
KSF, 1899.
Sonchus oleraceus
KSF, 1899.

sowthistle
Sonchus
CSJ, 1846.

†Spaniard
Aciphylla Colensoi
KSF, 1899.
CMN, 1906.

spaniard
Aciphylla Colensoi
CNZ, 1919.
CCN, 1924.
Aciphylla squarrosa
PLC, 1857.
HGC, 1862.
LB, 1906.

spathulate-leaved drosera
Drosera spathulata
LB, 1906.

spathulate-leaved myosotis
Myosotis spathulata
LB, 1906.

spear grass
Aciphylla squarrosa
TCS, 1851.
PLC, 1857.
HNP, 1867.
PPO, 1868.
Trans. 1, 1869.
Trans. 2, 1870.
MLN, 1890.
DDD, 1917.

spear-grass
Aciphylla Colensoi
HHN, 1867.
LCN, 1868.
Trans. 14, 1882.
Aciphylla squarrosa
KSF, 1899.
GST, 1921.

speargrass
‡*Aciphylla Ashcroftii*
Z, 1889.
Aciphylla squarrosa
CTP, 1908.
CKB, 1915.
CCN, 1924.
DDD (2), 1925.

speedwell
Veronica elliptica
CNZ, 1910.

sphagnum moss
Sphagnum
CNZ, 1919.

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† The Spaniard is probably referred to in the following:—"A little alpine vale lay bathed in sun and spray, all one garden of celmisia and lilies and gentians, thorny spikes of yellow, and moss of amber and of emerald. From the rock cliff two trees of lace-bark trailed branches of white blossoms downward to meet the ground flowers below." GHB, p. 199.

‡ No such name now recognised.

*spider-wood
Dracophyllum latifolium
EM, 1911.
spiderwood
Dracophyllum latifolium
CWK, 1908.
CNZ, 1910.
CNZ, 1919.
spiked bent grass
Deyeuxia quadriseta
CIG, 1880.
spiked bent-grass
Deyeuxia quadriseta
CSI, 1909.
spiked oat grass
Trisetum subspicatum
CIG, 1880.
spiked podocarpus
Podocarpus spicata
LB, 1906.
spiked reed grass
Deyeuxia quadriseta
CIG, 1880.
spiked rush
Eleocharis Cunninghamii
Trans. 1, 1869.
spinach
Chenopodium triandrum
Trans. 2, 1870.
Tetragonia expansa
TIM, 1855.
spineless piripiri
Acaena inermis
CNZ, 1919.
spiny rolling grass
Spinifex hirsutus
CIG, 1880.
spiny rolling-grass
Spinifex hirsutus
CNZ, 1910.
spoon-leaved forget-me-not
Myosotis spathulata
CSI, 1909.
spoon-leaved sun-dew
Drosera spathulata
CSI, 1909.
spoon-leaved sundew
Drosera spathulata
CTP, 1908.
THW, 1909.

spotted shield fern
Polystichum oculatum
POO, 1882.
spreading-orache
Atriplex patula
CNZ, 1919.
†spruce tree
Dacrydium cupressinum
CVS, 1773.
spur-grasses
Aciphylla sp.
HLB, 1865.
spurgewort
Euphorbia glauca
Trans. 2, 1870.
square-stemmed twig-rush
Claudium Vauthiera
CSI, 1909.
square-stemmed veronica
Veronica tetragona
CTP, 1908.
star-lily
Arthropodium candidum
CNZ, 1919.
starry hibiscus
Hibiscus trionum
LB, 1906.
stemless tree fern
Dicksonia lanata
DDD (2), 1925.
sterile wood
Coprosma foetidissima
HHN, 1867.
Stewart Island buttercup
Ranunculus Kirkii
CSI, 1909.
Stewart Island celmisia
Celmisia rigida
CSI, 1909.
Stewart Island cotula
Cotula Traillii
CSI, 1909.
Stewart Island shrubby groundsel
Senecio Stewartiae
CSI, 1909.

Stewart Island spaniard
Aciphylla Traillii
CNZ, 1919.
Stewart Island spear-grass
Aciphylla Traillii
CSI, 1909.
Stewart Island stilbocarpa
Stilbocarpa Lyallii
CSI, 1909.
CDA, 1911.
Stewart Island tree-groundsel
Senecio Stewartiae
CNZ, 1919.
Stewart Island uncinia
Uncinia pedicellata
CSI, 1909.
Stewart Island vegetable-sheep
Raoulia Goyeni
CSI, 1909.
CNZ, 1919.
sticks (of the shepherds)
Corallospartium crassicaule
KSF, 1899.
sticky-fern
Dryopteris punctata
DMs., 1921.
stiff-branched daisy-tree
Olearia divaricata
CSI, 1909.
stiff bristle fern
Trichomanes elongatum
POO, 1882.
stiff bristle-fern
Trichomanes strictum
CSI, 1909.
stiff bulrush
Scirpus nodosus
CKI, 1907.
stiff club-rush
Scirpus nodosus
CSI, 1909.
CDA, 1911.
stiff-stemmed coprosma
Coprosma crassifolia
CKB, 1915.

* So-called on account of the figure revealed in the cut stem.

†So-called from the similarity of its foliage to that of the American spruce. CVS, vol. 1, p. 95.

Beer was first brewed from its leaves on 27th March, 1773. CVS, vol. 1, p. 73: details of method of brewing, pp. 99, 100: and see p. 147.

stiff uncinia
Uncinia rigida
CTP, 1908.

stinking fern
Pteris tremula
FFN, 1890.

stinking-fern
Pteris tremula
FFN, 1890.

stinkwood
Coprosma foetidissima
DFC, 1896.
TIC, 1906.
CTP, 1908.
TNN, 1909.
THW, 1909.
DFC, 1916.
NZJS, 1918.

stitchwort
Stellaria parviflora
Trans. 1, 1869.

stout dwarf broom
Carmichaelia Monroi
CNZ, 1919.

stout water-milfoil
Myriophyllum robusta
CNZ, 1919.

straggling coprosma
Coprosma ramulosa
CSI, 1909.

straggling pittosporum
Pittosporum cornifolium
CWK, 1908.

strap-leaved sundew
Drosera binata
FAA, 1889.

strathmore weed
Pimela ? laevigata
Ver. (A).

stumpy tree-fern
Dicksonia lanata
CNZ, 1919.

stunted inaka
Dracophyllum longifolium
CNZ, 1919.

stunted southern rata
Metrosideros lucida
CNZ, 1919.

*stupid gentian
Gentiana corymbifera
BAF, 1863.

sturdy tree-fern
Dicksonia fibrosa
DMs., 1921.

subalpine koromiko
Veronica subalpina
CNZ, 1919.

subantarctic nettle
Urtica australis
CSI, 1909.

subantarctic sun-dew
Drosera stenopetala
CSI, 1909.

subantarctic tree-daisy
Olearia Lyallii
CNZ, 1919.

†summer spinach
Tetragonia expansa
CTN, 1830.

sun dew
Drosera spathulata
Trans. 2, 1870.

sun-dew
Drosera pygmaea
Trans. 10, 1878.

sun spurge
Euphorbia glauca
Trans. 1, 1869.

supple jack
Rhipogonum scandens
BGN, 1860.
HNF, 1888.

supple-jack
Rhipogonum scandens
TNC, 1856.
HHN, 1867.
Trans. 2, 1870.
HNB, 1890.
MLN, 1890.
LB, 1906.
TIC, 1906.
DFC, 1916.
CCN, 1924.

supplejack
Rhipogonum scandens
CVS, 1773.
NNV, 1817.
ENZ, 1832.
PNZ, 1838.
DNZ, 1843.
HCE, 1844.
MVC, 1864.
HGC, 1863.
PPO, 1868.
Trans. 2, 1870.
DRA, 1872.
DFC, 1896.

supplejack
Rhipogonum scandens
DCO, 1900.
CMN, 1906.
LB, 1906.
CKI, 1907.
CWK, 1908.
JM, 1909.
CNZ, 1910.
EM, 1911.
DDD, 1917.
CNZ, 1919.
GST, 1921.
NZJS, 1921.
CCN, 1924.
DDD (2), 1925.

supplejack vine
Rhipogonum scandens
Trans. 34, 1902.
EM, 1911.

supra-divaricating whauwhaupaku
Nothopanax anomalum
CNZ, 1919.

swamp astelia
Astelia nervosa
CNZ, 1919.

swamp-asteliad
Astelia nervosa
CNZ, 1919.

swamp-broom
Carmichaelia paludosa
CNZ, 1919.

swamp-buttercup
Ranunculus macropus
CKI, 1907

swamp club-rush
Scirpus inundatus
CSI, 1909.

swamp-coprosma
Coprosma tenuicaulis
CNZ, 1919.

swamp cotula
Cotula coronopifolia
CKI, 1907.
CSI, 1909.
CDA, 1911.
CNZ, 1919.

swamp fern
Gleichenia dicarpa
FFN, 1890.

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*Hardly a name, but merely a term of disparagement; but it is referred to in CNZ, 1919, p. 88.

†"Discovered in Cook's first voyage by Sir Joseph Banks, and was boiled and eaten as greens by the crew." CTN, p. 183.

swamp-fern
Dryopteris Thelypteris var. *squamulosa*
CNZ, 1919.
Dryopteris unitum
DMs., 1921.

swamp-heath
Dracophyllum paludosum
CNZ, 1919.

swamp-lawyer
Rubus Schmideloides
CNZ, 1919.

swamp-lily
Chrysobactron Hookeri
CNZ, 1919.

swamp-matipo
Suttonia Coxii
CNZ, 1910.
CNZ, 1919.

swamp moss
Sphagnum
HGC, 1863.

swamp pine
Podocarpus dacrydioides
Trans. 1, 1869.
Trans. 9, 1877.

swamp tree-daisy
Olearia virgata
CNZ, 1919.

swamp twig-rush
Cladium junceum
CNZ, 1919.

swamp umbrella fern
Gleichenia dicarpa
DDD (2), 1925.

swamp willow-herb
Epilobium pallidiflorum
CNZ, 1919.

sweet grass
Atropis stricta
CIG, 1880.

sweet-scented earina
Earina autumnalis
CSI, 1909.

sweet-scented holy grass
Hierochloe redolens
THW, 1909.

sweet-scented sacred grass
Hierochloe redolens
CIG, 1880.

sweet-scented swamp grass
Hierochloe redolens
NZCJ, 1883.

sweet-scented vernal grass
Hierochloe redolens
NZCJ, 1880.

sweet vernal grass
Hierochloe redolens
NZCJ, 1885.

sword-fern
Dryopteris cordifolia
DMs., 1921.

sword-grass
Arundo conspicua
DRA, 1872.

tailed doodia
Doodia caudata
LFN, 1875.

tailed spleenwort
Asplenium caudatum
POO, 1882.

tall bearded heath
Leucopogan fasciculatum
CKI, 1907.
CWK, 1908.
CDA, 1911.

tall eye-bright
Euphrasia cuneata
CKI, 1907.

tall haloragis
Halorrhagis erecta
CWK, 1908.

tall mingimingi
Leucopogon fasciculatum
CNZ, 1919.

tall native broom
Carmichaelia australis
CWK, 1908.

tall New Zealand broom
Carmichaelia odorata
CNZ, 1919.

tall pepper-tree
Macropiper excelsum
CKI, 1907.

tall red southern-beech
Nothofagus fusca
CNZ, 1919.

tall sedge
Carex appressa
CSI, 1909.

tall spike-rush
Eleocharis sphacelata
CSI, 1909.

tall uncinia
Uncinia leptostachya
CTP, 1908.

tall willow-herb
Epilobium erectum
THW, 1909.

tall willowherb
Epilobium erectum
CTP, 1908.

tangle-fern
Gleichenia circinata
POO, 1882.
CSI, 1909.
Gleichenia dicarpa
DMs., 1921.

tar-wood
Dacrydium Bidwillii
KFF, 1889.
Dacrydium biforme
KFF, 1889.
CMN, 1906.
CSI, 1909.
Dacrydium Colensoi
Trans. 9, 1877.

tarwood
Dacrydium biforme
CTP, 1908.

Tasmanian hard fern
Blechnum lanceolatum
LFN, 1875.

tassel pondweed
Ruppia maritima
CKI, 1907.

teak
Vitex lucens
PMC, 1840.
Trans. 1, 1869.

*tea plant
Leptospermum scoparium
CV, 1769-70.
CVS, 1773.

te tree
Cordyline australis
HCE, 1844.
LT, 1851.

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*The tea of commerce, not *manuka*, is referred to in NZCJ, 1888, p. 421: "the tea plant also flourishes in this favoured district."

*† tea tree
Leptospermum ericoides
Trans. 9, 1877.
Leptospermum scoparium
Trans. 9, 1877.
MLN, 1890.
HMB, 1898.

tea-tree
Leptospermum ericoides
Trans. 4, 1872.
KFF, 1889.
KSF, 1899.
Leptospermum scoparium
MTN, 1834.
HNR, 1842.
HCE, 1844.
HHN, 1867.
PPO, 1868.
Trans. 1, 1869.
FAA, 1889.
KFF, 1889.
KSF, 1899.
DCO, 1900.
CMN, 1906.
TIC, 1906.
THW, 1909.
CNZ, 1910.

teatree
Leptospermum ericoides
RDT, 1875.

teddywood
Ixerbia brexioides
Ver. (A).

tender polypody
Arthropteris tenella
POO, 1882.

ternate-leaved melicope
Melicope ternata
LB, 1906.

‡tetrandrous passion-flower
Tetraphaea australis
LB, 1906.

thick-leaved hard fern
Blechnum durum
POO, 1882.
CSI, 1909.

thick-leaved hard-fern
Blechnum durum
CNZ, 1919.

thick-leaved hymenanthera
Hymenanthera crassifolia
LB, 1906.

thick-leaved kohuhu
Pittosporum Kirkii
CNZ, 1919.

thick-leaved lancewood
Pseudopanax crassifolium
LB, 1906.

thick-leaved pittosporum
Pseudopanax crassifolium
LB, 1906.

thick-leaved polypody
Cyclophorus serpens
CWK, 1908.
CNZ, 1919.

thick-leaved shield fern
Polystichum adiantiforme
CWK, 1908.

thick-leaved shield-fern
Polystichum adiantiforme
CSI, 1909.

thick-leaved willow-herb
Epilobium crassum
CNZ, 1919.

thin-bark totara
Podocarpus Hallii
CCN, 1924.

thin-barked totara
Podocarpus Hallii
CTP, 1908.

thin bracken
Pteris macilenta
POO, 1882.

thin-leaved cheilanthes
Cheilanthes tenuifolia
POO, 1882.
CKB, 1915.

thin-leaved coprosma
Coprosma areolata
CSI, 1909.
CKB, 1915.

thin-leaved filmy fern
Hymenophyllum rarum
POO, 1882.
CTP, 1908.
CKB, 1915.

thin-leaved hard fern
Blechnum Norfolkiana
POO, 1882.

thin-leaved hypolepis
Hypolepis tenuifolia
POO, 1882.
CSI, 1909.
CKB, 1915.

thin-leaved maidenhair
Adiantum diaphanum
POO, 1882.

thin-leaved oru
Colensoa physaloides
CNZ, 1919.

thin-leaved pittosporum
Pittosporum tenuifolium
LB, 1906.
CTP, 1908.

thin-leaved tree-daisy
Olearia Hectori
CNZ, 1919.

Thomson's daisy
Lagenophora Thomsoni
CSI, 1909.

Thomson's naked oat grass
Danthonia nuda
CIG, 1880.

thousand-jacket
Hoheria populnea
FAA, 1889.
KFF, 1889.
Trans. 30, 1898.
KSF, 1899.
Ver. (WB).

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*The name is mis-spelt Ti tree in TSN, vol. 1, p. 19: he says: "The tough Ti tree furnished paddles and spears."

† "Ettay is a Tea tree, quite different to the Tea tree bush, a sort of myrtle." MTN, pp. 14-5. In the text are two rough drawings, one of a single-stemmed, the other of a bifurcated tree: these make it clear that *Cordyline* is here referred to. He writes, on his illustration: "Hettay or Ettay or tea tree," and explains that in Hettay, as in Hippah of Cook, the prefix *he* is only the article. This and the preceding note show the early confusion of the two words, Maori and English, "ti" and "tea."

‡ *Passiflora tetrandra* when so named by Laing.

thousand jackets
Hoheria populnea
SLM, 1902.

thousand leaves
Hypolepis mille-folium
POO, 1882.

thousand-leaves
Hypolepis mille-folium
CSI, 1909.

thread-fern
Blechnum filiforme
DMs., 1921.

thread-like violet
Viola filicaulis
LB, 1906.

Three Kings karo
Pittosporum Fair-childii
CNZ, 1919.

Three Kings milk-tree
Paratrophis Smithii
CNZ, 1919.

three-nerved cudweed
Gnaphalium trinerve
CNZ, 1919.

three-ribbed arrow-grass
Triglochin strictum var. *filifolium*
CSI, 1909.
CDA, 1911.
CNZ, 1919.

three-square
Scirpus americanus
CKI, 1907.
CDA, 1911.
CNZ, 1919.

thyme-leaved tute
Coriaria thymifolia
CSI, 1909.
CDA, 1911.

*Ti Mi (? = tainui)
Pomaderris apetala
PWW, 1889.

tiny gentian
Gentiana lineata
CSI, 1909.

tiny ourisia
Ourisia modesta
CSI, 1909.

tiny spear-grass
Aciphylla Monroi
CNZ, 1919.

ti palm
Cordyline australis
TCS, 1851.
POO, 1882.

ti-palm
Cordyline australis
BL, 1851.
TNC, 1856.

† ti-ti
?*Cordyline australis*
HCE, 1844.

ti tree
Cordyline australis
HNZ, 1857.
LCN, 1868.
POO, 1882.
CRA, 1884.
Leptospermum eri-coides
Trans. 9, 1877.
Leptospermum sco-parium
TSN, 1859.
Trans. 9, 1877

ti-tree
Cordyline australis
RHH, 1893.
Leptospermum sco-parium
FD, 1886.
BOS, 1900.
CNZ, 1910.
HEC, 1915.

‡titree
Cordyline australis
WM, 1918.
§ *Leptospermum sco-parium*
Ver

ti-tri
Cordyline australis
HMB, 1898.

toad-rush
Juncus bufonius
CSI, 1909.
CNZ, 1919.

toe-toe grass
Arundo conspicua
GST, 1921.

toetoe grass
Arundo conspicua
Trans. 20, 1888.

toetoe-grass
Arundo conspicua
CNZ, 1919.

tohe-tohe
Arundo conspicua
POO, 1882.

tohi grass
Arundo conspicua
POO, 1882.

toi-grass
Arundo conspicua
MVC, 1864.

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* "Among the trees Mr. Traill pointed out [on Stewart Island], was what he called a "Ti Mi" tree, and which he said was only found growing in one place in New Zealand, that being Mokai, on the west coast of the North Island. He stated that the Maori tradition about it was this—that the first Maoris who visited New Zealand came in a large canoe built of "Ti Mi" wood, and they landed at Mokaia, where there is a good harbour. The canoe got broken up, and some of the planks took root and grew." PWW, pp. 33-4. The canoe referred to was the "Tainui," and the tree is said to be the *karaka* or *kopi*. WAH, vol. 4, p. 38. Ti Mi is probably intended for *tainui*: this tree is said to have sprung from the skids of the "Tainui" canoe. CMN, p. 100.

† "The part of the plain . . . [near the foot of the Port Hills, about Christchurch] is uniformly covered with grass of various sorts, mixed with toi toi and flax in the moister parts, and, in some places, thickly dotted over with the ti-ti. The grass, generally speaking, is a tufty wire grass of a very dry nature . . ." Dr. David Monro in HCE, p. 236; and see p. 245.

‡ In the "Dominion" newspaper, 27th Feby., 1919, p. 4, last col., was reported the death of a Maori whilst catching wild horses on the Hauraki Plains: ". . . then the horse took to the titree, and was finally pulled up by the man's body catching in the scrub . . ."

§ An evident mistake for tea-tree. See note * to tea tree.

toi-toi grass
Arundo conspicua
DCO, 1900.
EM, 1911.

*toot
Coriaria sarmentosa
TNC, 1856.
PLC, 1857.

toothed bent grass
Deyeuxia Forsteri
CIG, 1880.

toothed bent-grass
Deyeuxia filiformis
CTP, 1908.
Deyeuxia Forsteri
CSI, 1909.
THW, 1909.
CKB, 1915.

toothed elæocarpus
Eleocarpus dentatus
LB, 1906.

toothed lancewood
Pseudopanax ferox
KFF, 1889.

toothed-leaf bracken
Histiopteris incisa
DMs., 1921.

toothed-leaved lancewood
Pseudopanax ferox
MNZ, 1905.

toothed olearia
Olearia semidentata
LB, 1906.

toothed shore spleenwort
Asplenium scleroprium
CSI, 1909.

tooth-leaved beech
Nothofagus fusca
RDT, 1875.
Trans. 12, 1880.
Trans. 17, 1885.

tooth-leaved beech
Nothofagus fusca
KFF, 1889.
CTP, 1908.

toot plant
Coriaria sarmentosa
HNP, 1867.
LCN, 1868.
PPO, 1868.
AD, 1908.

tortuous dock
Rumex flexuosus
LB, 1906.

totara pine
Podocarpus totara
DCO, 1900.

totarro
Podocarpus totara
RSC, 1844.

trailing-veronica
Veronica epacridea
CNZ, 1910.

Traill's daisy-tree
Olearia Traillii
CSI, 1909.

traveller's joy
Clematis hexasepata
HHN, 1867.
FAA, 1889.
Clematis indivisa
Trans. 2, 1870.
Trans. 17, 1885.

Travers' celmisia
Celmisia Traversii
LB, 1906.

Travers's veronica
Veronica Traversii
LB, 1906.

tree club-moss
Lycopodium densum
CWK, 1908.

tree coprosma
Coprosma arborea
LB, 1906.
CWK, 1908.

tree-coprosma
Coprosma arborea
CNZ, 1919.

tree-daisy
Olearia sp.
CNZ, 1919.

tree-flax
Astelia Solandri
Trans. 4, 1872.

tree fuchsia
Fuchsia excorticata
HNR, 1842.
LB, 1906.

tree-fuchsia
Fuchsia excorticata
LB, 1906.
CNZ, 1910.
CNZ, 1919.

† tree grass
? *Carex secta*
(Niggerhead)
HCE, 1844.

tree-heath
Dracophyllum arboreum
CNZ, 1919.

tree karamu
Coprosma arborea
KFF, 1889.

tree-karamu
Coprosma chathamica
CNZ, 1910.
CNZ, 1919.

tree-like hedycarya
Hedycarya arborea
LB, 1906.

tree manuka
Leptospermum ericoides
CKI, 1907.

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*Speaking of inhospitality occasionally met with at the hands of recently-arrived colonists, Paul says: "Those who came out in the last two or three ships have, I am told (with a few discreditable exceptions), passed with unprecedented rapidity through the crisis of unreasonableness, false pride, and grumbling, which old settlers call 'eating their tutu.'" A footnote explains: "The tutu (or *toot*, as it is generally pronounced) is a native shrub, the leaves of which may be eaten with safety by cattle gradually accustomed to its use, but are often fatal to newly-landed animals." PLC, p. 26. Out of five cows landed from the first four ships, Lyttelton, Canterbury, at the end of 1850, three died soon after landing; one fell over a cliff, and two were poisoned with tutu. LT, 11th Jan., 1851.

†Tuckett saw a grass, "a very cutting wiry species, very similar to that which in swamps we call tree grass, but without the stem or trunk on which the former is elevated above the water surface; these plumes of grass on this dry land in burning diffuse a fragrant and aromatic odour, but as food for cattle they are valueless." HCE, p. 220.—Dr. D. Munro called this the grass-tree, speaking of "grass-tree swamps." HCE, p. 245.

tree manuka
Leptospermum scoparium
Ver. (WB)

tree-manuka
Leptospermum ericoides
CNZ, 1910.
NZJS, 1921.

tree-moss
Polytrichum dendroides
CNZ, 1919.

tree nettle
Urtica ferox
DFC, 1916.

tree-nettle
Urtica ferox
Trans. 35, 1903.
CMN, 1906.
THW, 1909.
CKB, 1915.
Trans. 48, 1916.
CNZ, 1919.
NZJS, 1921.

tree toot
Coriaria sarmentosa
LCN, 1868.

tree tutu
Coriaria sarmentosa
LCN, 1868.

trembling bracken
Pteris tremula
LFN, 1875.
POO, 1882.
CWK, 1908.

triandrous chenopodium
Chenopodium triandrum
LB, 1906.

triangular hard fern
Blechnum vulcanicum
CTP, 1908.

triangular hard-fern
Blechnum vulcanicum
CNZ, 1919.

true lancewood
Pseudopanax lineare
CNZ, 1919.

true nettle
Urtica ferox
CKI, 1907.

true New Zealand flax
Linum monogynum
LB, 1906.

true pepper
Macropiper excelsum
DCO, 1900.

tua-tutu
Coriaria sarmentosa
HHN, 1867.

tufted filmy fern
Hymenophyllum pulcherrimum
CTP, 1908.

tufted grass
? *Poa caespitosa*
TCS, 1851.

tufted hair-grass
Deschampsia caespitosa
CSI, 1909.

tufted hectorella
Hectorella caespitosa
LB, 1906.

tufted ourisia
Ourisia caespitosa
LB, 1906.

Tunbridge fern
Hymenophyllum tunbridgense
POO, 1882.
FFN, 1890.
CWK, 1908.

Tunbridge-fern
Hymenophyllum tunbridgense
FFN, 1890.

Tunbridge filmy fern
Hymenophyllum tunbridgense
CKB, 1915.

tupak grass
Carex appressa
HHN, 1867.

turfy coprosma
Coprosma Petriei
CNZ, 1919.

turfy hair grass
Deschampsia caespitosa
CIG, 1880.

turfy raoulia
Raoulia subsericea
CNZ, 1919.

turpentine
Pittosporum eugenioides
Trans. 9, 1877.

turpentine-shrub
Dracophyllum uniflorum
CCN, 1924.

turpentine tree
Pittosporum crassifolium
FAA, 1889.

turpentine tree
Pittosporum eugenioides
KFF, 1889.
MLN, 1890.
NC, 1912.
Ver. (WB).
Pittosporum tenuifolium
Trans. 4, 1872.

tussac poa
Poa caespitosa
CIG, 1880.

tussock
Poa caespitosa
THW, 1909.

tussock-fescue
Festuca novae-zealdiae
CKB, 1915.

tussock grass
Poa caespitosa
CMN, 1906.

tussock-grass
Poa foliosa
CNZ, 1919.

tussock oat-grass
Danthonia Cunninghamii
CTP, 1908.
CSI, 1909.

twiggy daisy-tree
Olearia virgata
CSI, 1909.

twiggy olearia
Olearia virgata
LB, 1906.

twiggy pimelea
Pimelea virgata
LB, 1906.

twiggy tree-daisy
Olearia lineata
CNZ, 1919.

twiggy whitewood
Melicytus micranthus
CWK, 1908.

twining fern
Lygodium articulatum
CWK, 1908.

twining polypody
Cyclophorus serpens
POO, 1882.

twining string fern
Lygodium articulatum
POO, 1882.

twin-leaved drosera
Drosera binata
LB, 1906.

two-leaved caladenia
Caladenia bifolia
CSI, 1909.

two-valved filmy fern
Hymenophyllum bivalve
POO, 1882.

umbrella fern
Gleichenia Cunninghamii
NZCJ, 1877.
POO, 1882.
FFN, 1890.
CMN, 1906.
CTP, 1908.
DFN, 1921.
DDD (2), 1925.

umbrella-fern
Gleichenia Cunninghamii
TFF, 1882.
DDD, 1917.
DMs., 1921.

umbrella tree
Pseudopanax crassifolium
TNC, 1856.
Ver. (WB).

upright calceolaria
Jovellana Sinclairii
CNZ, 1919.

varied-leaved parsonsia
Parsonsia heterophylla
LB, 1906.

variegated willow-herb
Epilobium pictum
CSI, 1909.

varnished celmisia
Celmisia vernicosa
LB, 1906.

Vauvillier's cassinia
Cassinia Vauvilliersii
LB, 1906.

vegetable boa-constrictor
Metrosideros florida
HNZ, 1857.

vegetable sheep
Haastia pulvinaris
KSF, 1899.
CMN, 1906.
Raoulia eximia
HHN, 1867.
Trans. 3, 1871.
HRN, 1889.
KSF, 1899.
DCO, 1900.
LB, 1906.
CNZ, 1910.

vegetable sheep
Raoulia mammillaris
NZCJ, 1885.
KSF, 1899.
CMN, 1906.
LB, 1906.
CNZ, 1910.

vegetable-sheep
Raoulia eximia
HHN, 1867.
CCN, 1924.
Haastia pulvinaris
CCN, 1924.

veined bristle fern
Trichomanes venosum
LFN, 1875.
POO, 1882.
CWK, 1908.
CKB, 1915.

veined bristle-fern
Trichomanes venosum
CSI, 1909.

veined filmy-fern
Trichomanes venosum
DMs., 1921.

velvet boss fern
Dryopteris velutina
POO, 1882.

velvet fern
Dryopteris velutina
DMs., 1921.
Leptopteris superba
POO, 1882.

vesiculate eryngium
Eryngium vesiculosum
LB, 1906.

violet
Viola Cunninghamii
Trans. 2, 1870.
Viola filicaulis
Trans. 1, 1869.

Virgin's Bower
Clematis sp.
HNZ, 1857.

viscid dodonea
Dodonea viscosa
LB, 1906.

wait-a-bit
Rubus australis
Z, 1890.

wall spleenwort
Asplenium trichomanes
LFN, 1875.

water blink
Montia fontana
FAA, 1889.

water-buttercup.
Ranunculus rivularis
CKI, 1907.

water-buttons
Cotula coronopifolia
SPR, 1909.

water chickweed
Montia fontana
FAA, 1889.
CTP, 1908.

water-chickweed
Montia fontana
CSI, 1909.
CNZ, 1919.

water club-rush
Scirpus inundatus
CKI, 1907.

waterfall veronica
Veronica catarractae
LB, 1906.
DDD, 1917.

water fern
Histiopteris incisa
Ver. (A).

water-fern
Histiopteris incisa
CKB, 1915.
CNZ, 1919.

water lily
Ranunculus Lyallii
HHN, 1867.
Trans. 4, 1872.
FAA, 1889.

water-lily
Ranunculus Lyallii
HHN, 1867.

water milfoil
Myriophyllum elatinoides
Trans. 1, 1869.

water-milfoil
Myriophyllum sp.
CNZ, 1919.
Myriophyllum elatinoides
KSF, 1899.

water-penny violet
Viola filicaulis var. *hydrocotyloides*
Trans. 14, 1882.
CSI, 1909.

water persicaria
Polygonum serrulatum
CKI, 1907.

water-starwort
Callitriche sp.
CNZ, 1910.
CNZ, 1919.

water-wort
Elatine americana var. *australiensis*
CSI, 1909.

wavy-leaved rangiora
Brachyglottis repanda
LB, 1906.
CKI, 1907.
CWK, 1908.

waxy gentian
Gentiana cerina
LB, 1906.

weak poa
Poa imbecilla
CSI, 1909.
CKB, 1915.
NZJS, 1923.

weak-stemmed parietaria
Parietaria debilis
LB, 1906.

weak-stemmed poa
Poa imbecilla
CIG, 1880.

wedge-leaved coprosma
Coprosma cuneata
CTP, 1908.

weeping matipo
Suttonia divaricata
CTP, 1908.

weeping-matipo
Pittosporum rigidum
CNZ, 1910.
Suttonia divaricata
CSI, 1909.

*weeping pine
Dacrydium pendulum
STT, 1850.

weeping tree
Rapanea montana
Trans. 17, 1885.

West Coast ribbonwood
Plagianthus Lyallii
MNZ, 1905.

Westland pine
Dacrydium Colensoi
KFF, 1889.
MNZ, 1905.
CNZ, 1910.
Trans. 43, 1911.
Ver. (WB).

Westland silver-pine
Dacrydium Colensoi
CWK, 1908.

weta (= contr. of putaputaweta)
Carpodetus serratus
OTR, 1916.

wet-rock koromiko
Veronica linifolia
CNZ, 1919.

whip-cord
Asplenium flabellifolium
HFN, 1890.

whipcord koromiko
Veronica tetragona
CNZ, 1919.

whipcord veronica
Veronica lycopodioides and ors.
LB, 1906.

whip-like carmichaelia
Carmichaelia flagelliformis
LB, 1906.

white arthropodium
Arthropodium candidum
LB, 1906.

white beech
Nothofagus Solanderi
MLN, 1890.

white birch
Carpodetus serratus
RDT, 1875.
KFF, 1889.
Nothofagus cliffortioides
HGC, 1862.
HHN, 1867.
CCV, 1872.
Trans. 17, 1885.
KFF, 1889.
Nothofagus Menizesii
Trans. 17, 1885.
KFF, 1889.
Ver. (WB).
Nothofagus Solanderi
HHN, 1867.
Trans. 17, 1885.
KFF, 1889.
CMN, 1906.
Quintinia serrata
KFF, 1889.
Weinmannia racemosa
Ver. (WB).

white-birch
Nothofagus cliffortioides
MNZ, 1905.
Nothofagus Menziesii
MNZ, 1905.

white bog-gentian
Gentiana Townsoni
CNZ, 1919.

white buttercup
Ranunculus Lyallii
DCO, 1900.

white carrot
? *Geranium dissectum*
TIM, 1855.

white clematis
Clematis indivisa
CNZ, 1919.
CCN, 1924.

white climbing rata
Metrosideros albiflora
CWK, 1908.
Metrosideros hypericifolia
CKI, 1907.

white climbing-rata
Metrosideros albiflora
CNZ, 1919.

white cudweed
Gnaphalium luteo-album
CKI, 1907.
CWK, 1908.
CKB, 1915.

white cushion-celmisia
Celmisia sessiliflora
CNZ, 1919.

white cut-leaved alpine buttercup
Ranunculus Buchanani
CNZ, 1919.

white fireweed
Erechtites quadridentata
CSI, 1909.

white flax
Linum monogynum
HNF, 1888.
CKI, 1907.
CSI, 1909.
CDA, 1911.
Trans. 46, 1914.
CKB, 1915.

* "There is, I consider, a second species, which I have called the weeping pine, *Dacrydium pendulum*." STT, p. 227.

white-flowered flax
Linum monogynum
TNN, 1909.

white-flowered poa
Poa sclerophylla
CIG, 1880.

white-flowered rata
Metrosideros albiflora
LB, 1906.

white-flowering rata
Metrosideros albiflora
FAA, 1889.

white-fruited gunnera
Gunnera albocarpa
CSI, 1909.

white gentian
Gentiana saxosa
NZCJ, 1888.

white hinau
Elaeocarpus Hookerianus
THW, 1909.
Ver. (WB).

white kamai
Nothofagus Menziesii
Trans. 9, 1877.

white-leaved lawyer
Rubus schmidelioides var. *coloratus*
CSI, 1909.
CNZ, 1919.

white maire
Olea Cunninghamii
Ver. (WB).
Olea lanceolata
KFF, 1889.
CMN, 1906.
LB, 1906.
CWK, 1908.
THW, 1909.
DDD, 1917.
CCN, 1924.

white-maire
Olea lanceolata
MNZ, 1905.

white mangrove
Avicennia officinalis
Trans. 1, 1869.
KFF, 1889.

white manuka
Leptospermum ericoides
Trans. 9, 1877.

white mapau
Carpodetus serratus
RDT, 1875.
Trans. 9, 1877.
KFF, 1889.

white mapau
Pittosporum eugenioides
CCV, 1872.
KFF, 1889.
LB, 1906.
TNN, 1909.

white maple
Carpodetus serratus
KFF, 1889.
Ver. (WB).
Pittosporum eugenioides
Ver. (A).

white marigold
Senecio Lyallii
NZCJ, 1885.

white matipo
Carpodetus serratus
CCV, 1872.

white mountain daisy
Celmisia coriacea
KSF, 1899.

white mountain-musk
Celmisia incana
CNZ, 1919.

white oxalis
Oxalis magellanica
CNZ, 1919.

white pine
Podocarpus dacrydioides
PNZ, 1838.
PMC, 1840.
STT, 1850.
PPO, 1868.
Trans. 1, 1869.
KFF, 1889.
VTN, 1896.
CMN, 1906.
LB, 1906.
OTR, 1916.

white-pine
Podocarpus dacrydioides
Trans. 31, 1899.
MNZ, 1905.
TIC, 1906.
CWK, 1908.
THW, 1909.
Trans. 44, 1912.
NZJS, 1921.
CCN, 1924.

white poroporo
Solanum aviculare var. *albiflora*
Trans. 52, 1920.

white rata
Metrosideros albiflora
HNF, 1888.
DDD, 1917.

white rata
Metrosideros hypericifolia
OTR, 1916.
Metrosideros scandens
HMB, 1898.

white shore forget-me-not
Myosotis albida
CNZ, 1919.

white shore-gentian
Gentiana saxosa
CNZ, 1919.

white silver pine
Dacrydium Colensoi
Trans. 10, 1878.
KFF, 1889.

white sorrel
Oxalis magellanica
TIM, 1855.

white tea-tree
Leptospermum ericoides
KFF, 1889.
CTP, 1908.
THW, 1909.
CNZ, 1910.
CDA, 1911.
CNZ, 1919.

white tree fern
Cyathea dealbata
Ver. (WB).

white violet
Viola Lyallii
TIM, 1855.

white wood
Schefflera digitata
Trans. 2, 1870.

white-wood
Melicytus ramiflorus
EM, 1911.

whitewood
Melicytus ramiflorus
CCV, 1872.
CKI, 1907.
CWK, 1908.
THW, 1909.
HEC, 1915.
Ver. (WB).

whiteywood
Melicytus ramiflorus
Ver. (Stony Bay)

wide-branched ribbonwood
Plagianthus divaricatus
LB, 1906.

wiggybush
Muehlenbeckia sp.
Ver. (A).

wild calceolaria
Jovellana Sinclairii
GST, 1921.

wild carrot
Daucus brachiatus
Trans. 2, 1871.
CKB, 1915.

***wild celery**
Apium prostratum
CVN, 1777.
Trans. 20, 1888.
KSF, 1899.
CSI, 1909.
CDA, 1911.
Trans. 43, 1911.
CNZ, 1919.

wild cherry
Plagianthus Lyallii
FAA, 1889.

wild heliotrope
Ageratum conyzioides
Trans. 20, 1888.
CMN, 1906.
CNZ, 1910.
CNZ, 1919.

†‡wild Irishman
Discaria toumatou
WDJ, 1850.
TNC, 1856.
HHN, 1867.
HNP, 1867.
Trans. 1, 1869.
Trans. 3, 1871.
DFC, 1896.
HMB, 1898.
DCO, 1900.
LB, 1906.
CKI, 1907.
DFC, 1916.

Rubus australis
LCN, 1868.
Ver. (WB).

wild-irishman
Discaria toumatou
CNZ, 1910.
CDA, 1911.
Trans. 46, 1914.
CNZ, 1919.
NZJS, 1921.

wild mangrove
Myoporum laetum
Trans. 42, 1910.

wild pine-apple
Freycinetia Banksii
HNZ, 1857.

wild Spaniard
Aciphylla sp.
HNP, 1867.
Aciphylla Colensoi
HHN, 1867.
Trans. 1, 1869.
Aciphylla squarrosa
TNC, 1856.
HHN, 1867.
LCN, 1868.
DCO, 1900.
LB, 1906.
DFC, 1916.

wild thyme
Samolus repens var. *procumbens*
HHN, 1867.

willow-herb
Epilobium sp.
TIC, 1906.
CNZ, 1910.
CNZ, 1919.
CCN, 1924.

willow-leaved rapanea
Rapanea salicina
LB, 1906.

willow-leaved veronica
Veronica salicifolia
LB, 1906.

willow plant
Muehlenbeckia australis
TIM, 1855.

wine berry
Aristotelia racemosa
Trans. 2, 1870.

wine-berry
Aristotelia racemosa
KFF, 1889.
VTN, 1896.
HMB, 1898.
LB, 1906.
EM, 1911.

wineberry
Aristotelia racemosa
VTN, 1896.
KSF, 1899.
CMN, 1906.
CKI, 1907.
CWK, 1908.
CTP, 1908.
THW, 1909.
CNZ, 1910.
EM, 1911.
Trans. 44, 1912.
CNZ, 1919.
CCN, 1924.

wine-berry shrub
Coriaria sarmentosa
BGN, 1860.
LCN, 1868.

wire-rush
Hypolaena lateriflor
CNZ, 1919.

wiry corokia
Corokia cotoneaste
CKB, 1915.

wiry dichelachne
Dichelachne stipoid
CIG, 1880.

wiry-leaved oat grass
Danthonia australis
CIG, 1880.

wiry matipo
Suttonia divaricata
CNZ, 1919.

wiry snowberry
Gaultheria perplexa
CNZ, 1919.

witches-broom
Aecidium kowhai
Aecidium myopori
Trans. 55, 1924.

woodroof
Asperula perpusilla
Trans. 1, 1869.

wood-rush
Luzula campestris
CKI, 1907.
CNZ, 1919.
Luzula racemosa
TIC, 1906.
CNZ, 1910.

* "Among other plants that were useful to us, may be reckoned wild celery, which grows plentifully in almost every cove; especially if the natives have ever resided there before; and one that we used to call scurvy-grass." CVN, vol. 2, p. 148.

†The name Irishman is not mentioned in SSD, though the writer traversed South Canterbury and writes of the plant itself.

‡"Little or no wood but gigantic 'Wild Irishmen' here as large as hawthorns . . ." WDJ, in LT, 8th March, 1851, p. 7, col. 1.

woodrush
Luzula campestris
CTP, 1908.

wood-sorrel
Oxalis magellanica
CNZ, 1910.
DFC, 1916.

woolly cloak fern
Nothochlaena distans
POO, 1882.
DFN, 1921.

woolly cloak-fern
Nothochlaena distans
CKB, 1915.

woolly dicksonia
Dicksonia lanata
POO, 1882.

woolly fireweed
Erechtites arguta
CSI, 1909.

woolly tangle-fern
Gleichenia dicarpa
POO, 1882.
CSI, 1909.

woolly tree fern
Dicksonia fibrosa
FFN, 1890.

woolly tree-fern
Dicksonia lanata
CTP, 1908.
THW, 1909.

wrinkled elatostema
Elastostema rugosum
LB, 1906.

wrinkled willow-herb
Epilobium neterioides
CKI, 1907.
CSI, 1909.
CDA, 1911.
CKB, 1915.

yam-creeper
Rhipogonum scandens
Trans. 47, 1915.

yellow akeake
Olearia Forsteri
Ver. (WB).

yellow alpine buttercup
Ranunculus Godleyanus
CNZ, 1919.

yellow birch
Nothofagus Solanderi
Trans. 17, 1885.

yellow-button
Cotula coronopifolia
KSF, 1899.
LB, 1906.

yellow cassinia
Cassinia fulvida
LB, 1906.

yellow clematis
Clematis Colensoi
CKI, 1907.
CNZ, 1919.

yellow clianthus
Sophora microphylla
TNC, 1856.

yellow eyebright
Euphrasia Cockayniana
CNZ, 1919.

yellow-flowered leafless clematis
Clematis afoliata
CNZ, 1919.

yellow forget-me-not
Myosotis australis
DCO, 1900.
CNZ, 1919.

yellowish-white gnaphalium
Gnaphalium luteo album
LB, 1906.

yellow karamu
Coprosma linarifolia
KFF, 1889.

yellow kowhai
Sophora tetraptera
FAA, 1889.
SLM, 1902.
LB, 1906.
CWK, 1908.
Ver. (WB).

yellow-leaved mountain-cottonwood
Cassinia Vauvilliersii
CNZ, 1919.

yellow mistletoe
Loranthus flavidus
LB, 1906.
CTP, 1908.
THW, 1909.

yellow mountain lily
Ranunculus Godleyanus
NZCJ, 1885.
FAA, 1889.

yellow oxalis
Oxalis corniculata
TNC, 1856.
CWK, 1908.
CNZ, 1919.

yellow parrot's bill
Sophora tetraptera
HNZ, 1857.

*yellow pine
Agathis australis
PNZ, 1838.
PMC, 1840.
HNZ, 1857.
Dacrydium biforme
CCV, 1872.
KFF, 1889.
CMN, 1906.
Dacrydium Colensoi
Trans. 9, 1877.
GCN, 1888.
HRN, 1889.
Podocarpus dacrydioides
Ver. (WB).

yellow-pine
Dacrydium biforme
CTP, 1908.
CSI, 1909.
THW, 1909.
†*Dacrydium Colensoi*
MNZ, 1905.
Dacrydium intermedium
CSI, 1909.
CNZ, 1910.
CNZ, 1919.
CCN, 1924.

* "After Cook made this valuable timber known, no attempt was made to secure a cargo till 1820, when the store ships 'Dromedary and Coromandel' were sent expressly from England, and a small vessel, the 'Prince Rupert,' from Sydney. Few kauri spars were secured, their lading consisting principally of the inferior white pine kahikatea, and this injured the name of the kauri." PNZ, vol. 2, pp. 388-89.

†Matthews in MNZ is quoting Blair, Trans. 9, 1877, but inserts the hyphen—yellow-pine instead of yellow pine: he has also inserted the hyphen in red-birch, silver-pine and white-birch.

yellow-prickled lawyer
Rubus crissoides
CNZ, 1919.

yellow rock-daisy
Senecio saxifragoides
DCO, 1900.

yellow rush
Leptocarpus simplex
CDA, 1911.

yellow sand-sedge
Scirpus frondosus
CSI, 1909.

yellow sedge
Carex Oederi var. *cataractae*
CSI, 1909.

yellow shrub
Cassinia fulvida
OTR, 1916.

yellow silver pine
Dacrydium intermedium
Trans. 10, 1878.
KFF, 1889.
CMN, 1906.

yellow silver-pine
Dacrydium intermedium
MNZ, 1905.
CSI, 1909.

yellow tainui
Pomaderris elliptica
OTR, 1916.

yellow tussock
Poa caespitosa
GST, 1921.

yellow wood
Coprosma grandifolia
Ver. (WB).
Coprosma linarifolia
LCN, 1868.
DFC, 1896.

yellow-wood
Coprosma linarifolia
KFF, 1889.
CKB, 1915.
CCN, 1924.
Coprosma lucida
THW, 1909.

yellow wood-sorrel
Oxalis corniculata
SPR, 1909.

Young's bent grass
Deyeuxia Youngii
CIG, 1880.

Young's oat grass
Trisetum Youngii
CIG, 1880.

Young's oat-grass
Trisetum Youngii
CTP, 1908.

LIST OF AUTHORITIES QUOTED.

AD	....	New Zealand Department of Agriculture. *Annual Report*	
AJ	....	Journal of Department of Agriculture (one entry, under scabweed)	
ASC	....	ADAMS, C. W., *A Spring in the Canterbury Settlement*	L. 1853
ATD	....	ADAMS, ROBERT NOBLE, *The Counterfeit Seal.* A tale of Otago's first settlers	1897
B	....	*The Botanist*, containing accurately coloured figures, of tender and hardy ornamental plants ... conducted by B. MAUND, F.L.S., assisted by the REV. J. S. HENSLOW, M.A., F.L.S., etc., (4 vols.)	L. 1837-46
BAF	....	BUTLER, SAMUEL, *A first year in the Canterbury Settlement*	L. 1863
BGN	....	BENNETT, GEORGE, M.D., F.L.S., F.Z.S. *Gatherings of a naturalist in Australasia*	L. 1860
BJ	....	*Journal of the Right Hon. Sir Joseph Banks, Bart.*, K.B., F.R.S., during Captain Cook's first voyages in H.M.S. Endeavour in 1768-71 to Terra del Fuego, Otahite, New Zealand, Australia, the Dutch East Indies, etc. Edited by SIR JOSEPH D. HOOKER	L. 1896
BL	....	BARKER, DR. ALFRED C. Letter about the new Canterbury settlement, dated 18th June, 1851	
BN	....	BUCHANAN, JOHN D. Notes on the botany of Mount Egmont and neighbourhood, New Zealand, February, 1867. (In Linnean Society's Journal, Botany, vol. 10.)	
BNZ	....	BULLER, REV. JAMES. *Forty years in New Zealand*	L. 1878
BOS	....	BOYD, MARY STUART, *Our stolen summer: the record of a roundabout tour*	L. 1900
BRP	....	BRODIE, WALTER, *Remarks on the present state of New Zealand, its government, capabilities, and prospects*	L. 1845
BSL	....	BARKER, LADY MARY ANN. *Station life in New Zealand* [Canterbury, 1865-68]	L. 1870

BWM .... BELL, JAMES MACKINTOSH. *The wilds of Maoriland* .... L. 1914

CCN .... COCKAYNE, LEONARD, Ph.D., F.L.S., F.N.Z. Inst., F.R.S. The Cultivation of New Zealand Plants. .... We. 1924

CCO .... COCKAYNE, LEONARD. In *Canterbury old and new* .... Chch. 1900

CCV .... *Catalogue of the Colonial and Vienna Exhibition* 1872-3

CDA .... COCKAYNE, LEONARD, Ph.D., F.L.S. Report on the dune-areas of New Zealand, their geology, botany, and reclamation. In *Appendices to House of Representatives, N.Z.*, Paper C-13, 1911.

CIG .... Colonial Museum of New Zealand. *The indigenous grasses of New Zealand.* Illustrated by JOHN BUCHANAN .... We. 1880

CJT .... CRUISE, RICHARD A., *Journal of a ten months residence in New Zealand* .. .. L. 1823
[Cruise was in the "Dromedary" sent out from England in 1820 for a cargo of kauri spars.]

CKB .... COCKAYNE, LEONARD, Ph.D., F.L.S., F.R.S. Notes on the plant covering of Kennedy's Bush and other scenic reserves of the Port Hills (Canterbury). In *Appendices to House of Representatives, N.Z.*, Paper C-6., 1915 ....

CMN .... CHEESEMAN, THOMAS FREDERIC, F.L.S., F.Z.S. *Manual of the New Zealand Flora* .... We. 1906

CNZ .... COCKAYNE, LEONARD, Ph.D., F.L.S., F.R.S., New Zealand plants and their story .... We. 1910
Ed. 2 We. 1919

CRA .... COX, ALFRED. *Recollections*: Australia, England, Ireland, Scotland, New Zealand .... Chch. 1884

CSC .... CLARK, KATE MCCOSH. *A Southern Cross Fairy tale.* .... L. 1891
[At the end are notes on the fauna and flora of New Zealand so far as these are referred to in the story.]

CSI .... COCKAYNE, LEONARD, Ph.D. Report on a botanical survey of Stewart Island. In *Appendices, House of Representatives, N.Z.* Paper C-12 1909.

CSJ .... The Calendar of St. John's College, New Zealand, 1846.
[The New Zealand Church Almanac.]

CTN .... CRAIK, GEORGE LILLIE. *The New Zealanders.* .... L. 1830
[Library of entertaining knowldege.]

CTP .... COCKAYNE, LEONARD, Ph.D. Report on a botanical survey of the Tongariro National Park. In *Appendices, House of Representatives N.Z.* Paper C-11, 1908.

CV .... HAWKESWORTH, JOHN. An account of the voyages undertaken by the order of His present Majesty for making discoveries in the Southern Hemisphere and successively performed by Commodore Byron, Captain Wallis, Captain Carterat, and Captain Cook—in three volumes .... L. 1773
[Cook's voyages were during 1768-71, and comprise Vols. 2 and 3.]

CVN .... A voyage to the Pacific Ocean. Undertaken by the command of His Majesty, for making discoveries in the Northern Hemisphere.... Performed under the direction of Captains Cook, Clerke, and Gore, in His Majesty's Ships the "Resolution" and "Discovery" in the years 1776, 1777, 1778, 1779 and 1780—in 3 vols. L. 1784

CVS .... COOK, JAMES. *A voyage towards the South Pole, and round the world.* Performed in His Majesty's Ships the "Resolution" and "Adventure" in the years 1772, 1773, 1774 and 1775. .... L. 1779

CVT .... CROZET, ——. *Crozet's voyages to Tasmania, New Zealand, the Ladrone Islands, and the Philippines,* in the years 1771-1772. Translated by H. LING ROTH L. 1891

CWK .... COCKAYNE, LEONARD, Ph.D. Report on a botanical survey of the Waipoua kauri forest. In *Appendices, House of Representativse, N.Z.* Paper C-14, 1908

DCO .... DENDY, ARTHUR, D.Sc, F.L.S. In *Canterbury old and new* .... Chch. 1900

DDD .... DUNCAN AND DAVIES. Descriptive catalogue of New Zealand's native trees, shrubs, plants, ferns, and seeds: Grown and collected by Duncan and Davies Limited, native tree specialists, New Plymouth, N.Z. N.P. 1917

DDD (2) DUNCAN AND DAVIES LTD. *New Zealand Native Trees, Shrubs, Plants, Ferns and Seeds* .... N.P. 1925

DFC .... Dunedin Field Club. Catalogues of the indigenous and introduced flowering plants, ferns and seaweeds, occurring in the Dunedin district .... Dun. 1896
Dun. 1916

DFN .... DOBBIE, H. B., *New Zealand ferns* .... Auck. &c. 1921

DMs. .... Names in list with letters from H. B. Dobbie, Auckland, 21st Nov., 1921.

DNZ .... DIEFFENBACH, ERNST. *Travels in New Zealand*—2 vols. L. 1843

DRA .... DOMETT, ALFRED. *Ranolf and Amohia: A south-sea day-dream* .... L. 1872

DOMETT, ALFRED. *Ranolf and Amohia: A dream of two lives* (2 vols.) .... L. 1883

EM .... M'LEAN, J. C., M.B.O.U. In "*The Emu,*" Vol. XI., 1911-12

ENZ .... EARLE, AUGUSTUS. *Narrative of a nine months' residence in New Zealand* in 1827 .... L. 1832
[Earle was draughtsman on H.M.S. "Beagle."]

FAA .... FEATON, E. H. and S. FEATON. *Art album of New Zealand Flora.* vol. 1. .... We. 1889
[No more published.]

FFN .... FIELD, H. C. *The ferns of New Zealand and its immediate dependencies* .... Wang. 1890

FO .... FROUDE, JAMES ANTHONY. *Oceana: or England and her Colonies* .... L. 1886

GCN .... GISBORNE, WILLIAMS, *The Colony of New Zealand*: its history, vicissitudes and progress .... L. 1888
[A report, on p. 295, &c., by Thomas Laslett, late Timber Inspector and Surveyor of Forests to the Admiralty, on exhibit of N.Z. timbers at the Colonial and Indian Exhibition, 1886.]

GHB .... GROSSMAN, MRS. EDITH SEARLE. *The heart of the bush* L. 1910
[A novel. Excellent descriptions of scerery.]

GST .... GUTHRIE-SMITH, H., *Tutira* Ed. and Lond. 1921

HCE .... HOCKEN, THOMAS MORLAND. *Contributions to the early history of New Zealand.* [Settlement of Otago.] .... L. 1898
[Included as Appendices are: Frederick Tuckett's diary, 28th March to 1st June, 1844, of a journey from Port Cooper to the Bluff, pp. 203-225; *and*
Notes by Dr. David Monro of a journey through a part of the Middle Island of New Zealand (he was one of the same party as Tuckett), pp. 230-263. The Notes were published in the *Nelson Examiner*, 1844, and copied in the *New Zealand Journal*, 1845.]

HEC .... HAY, JAMES. *Reminiscences of earliest Canterbury (principally Banks Peninsula) and its settlers* .... Chch. 1915

HFN .... HARRIS, E. C. *New Zealand ferns* [Illustrations only] Nel. 1890

HFZ .... HARRIS, E. C. *New Zealand flowers.* [Illustrations only] Nel. 1890

HGC .... VON HAAST, JULIUS, Ph.D., F.R.S. *Geology of the Provinces of Canterbury and Westland, New Zealand*: a report comprising the results of official explorations [from 1861 to 1876] . ... Chch. 1879

HHN .... HOOKER, JOSEPH D., M.D. &c., *Handbook of the New Zealand flora* .... L. 1867

HLB .... HAAST, JULIUS. *Lake basins and glaciers of New Zealand.*
[A pamphlet, reprint from Quarterly Journal of the Geological Society for May, 1865.]

HLN .... HARPER, ARCHDEACON HENRY WILLIAM. *Letters from New Zealand*, 1857 to 1911 .... L. 1914

HMB .... HUDSON, G. V., F.E.S. *New Zealand moths and butterflies* .. .. L. 1898

HNB .... HARRIS, E. C. *New Zealand berries.* [Illustrations only.] Nel. 1890

HNF .... HETLEY, MRS. CHARLES. *The native flowers of New Zealand illustrated in colours* .... L. 1888

HNP .... VON HOCHSTETTER, FERDINAND. *New Zealand: its physical geography, geology, and natural history* .... Stutt. 1867
[The original, in German, Stutt. 1863, is part of the publication detailing the results of the Novara expedition.]
[Note.—The Appendix with list of trees, etc., pp. 167-169, is extracted from "a leaf from the natural history of New Zealand" by Richard Taylor of Wellington, 1848.]

HNR .... HEAPHY, CHARLES. *Narrative of a residence in various parts of New Zealand* .... L. 1842
[Heaphy was draughtsman of the New Zealand Company.]

HNZ .... HURSTHOUSE, CHARLES FLINDERS, *New Zealand, or Zealandia, the Britain of the South.* (2 vols.) .... L. 1857

HRN .... HETLEY, MME. CH. *et* M. E. RAOUL, *Fleurs sauvages et bois précièux de la Nouvelle-zélande* .... Londres-Paris 1889

HSL .... *Transactions of the Horticultural Society of London* quoted by Colenso in *Trans. N.Z. Inst.*, 1885, pp. 297(8).

JM .... JOURDAIN, W. R. Report on the Mokau River, by W. R. Jourdain, Secretary to the Scenery Preservation Board. In *Appendices, House of Representatives, N.Z.* Paper C-6, Appendix D, 1909.

KC .... KENNAWAY, LAURENCE J. *Crusts: a settler's fare due South* .... L. 1874
[Pastoral life in Canterbury, about 1851-60.]

KFF .... KIRK, THOMAS. *The forest flora of New Zealand* .... We. 1889

KSF .... KIRK, THOMAS. *The Students' Flora of New Zealand* We. 1899

LB .... LAING, ROBERT M. and MISS E. W. BLACKWELL. *Plants of New Zealand* .... Chch. 1906

LCN .... LINDSAY, W. LAUDER, M.D. *Contributions to New Zealand botany* .... L. 1868

LFN .... LOGAN, H. E. S. *Ferns which grow in New Zealand and adjacent islands, plainly described* .... Auck. 1875

LNZ .... LAING, JOHN DUNMORE. *New Zealand in 1839*: or four letters to the Right Hon. Earl Durham .... L. 1839

LT .... LYTTELTON TIMES. The first newspaper published in Canterbury: first number 11th January, 1851: then issued weekly, now daily

MAP .... MURRAY, JOHN, F.S.A., F.L.S., etc. *An account of the phormium tenax; or New-Zealand flax.* Printed on paper made from its leaves (bleached). With a postscript on paper .... L. 1838

MHG .... MURPHY, M., F.L.S. *Handbook of New Zealand gardening.* Ed. 1. .... [1885]
[List of New Zealand alpine plants furnished by Messrs. Adams and Son, pp. 161-2.]

MI .... *Maoriland*: an illustrated handbook to New Zealand. Issued by the Union Steam Ship Company of New Zealand .... Melb. 1884

MK .... MARRINER, GEORGE, F.R.M.S. *The Kea: a New Zealand problem* .... Chch. 1908

MLN .... MATTHEWS, GEORGE. Descriptive and priced list of New Zealand native ferns, plants, trees, shrubs, seeds, etc., on sale by George Matthews, Nurseryman and Seed-merchant, Moray Place, Dunedin .... Dun. [c. 1890]

MMR .... *Melanesian Mission Reports*, 1873-1881. First voyage of the new "Southern Cross," 1874.

MNZ .... MATTHEWS, HENRY J. *Tree-culture in New Zealand* .... We. 1905
[Chief Forester of the New Zealand Government.]

MOA .... MUNDY, LT.-COL. GODFREY CHARLES. *Our antipodes; or residence and rambles in the Australasian colonies* (3 vols.) .... L. 1852

MSE .... VON MUELLER, BARON FERDINAND, K.C.M.G., etc. *Select extra-tropical plants, readily eligible for industrial culture or naturalisation, with indications of their native countries and some of their uses.* Ed. 7 .... Melb. 1888

MSO .... MCINDOE, JAMES. *A sketch of Otago, from the initiation of the settlement* Dun.1878

MTN .... MARKHAM, EDWARD. *A transcript of New Zealand, or recollections of it.* By Edward Markham 1834
[The transcript is from the manuscript of Markham, who spent nine months in New Zealand, Feb.-Oct., 1834, having been a passenger by the brig "Brazil Packet." It is roughly illustrated by the author, and the illustrations assist in the identification of trees, etc., mentioned.]

MVC .... MUELLER, FERDINAND, Ph.D., M.D., etc. *The vegetation of the Chatham Islands.* .... Melb. 1864

NC .... NAIRN AND SON. *Catalogue*, 1912.

NNV .... NICHOLAS, JOHN LIDDIARD. *Narrative of a voyage to New Zealand, performed in the years 1814 and 1815, in company with the Rev. Samuel Marsden.* (2 vols.) L. 1817

NZCJ .... *New Zealand County Journal.* A record of information connected with agriculture... published by... the Canterbury Agricultural and Pastoral Association. Yearly volumes. Vol. 1, 1877–Vol. 22, 1898

NZJ .... *New Zealand Journal*
[Published in London every two weeks, and containing information regarding New Zealand. Vol. 1, 1840–11, 1850—then for a time incorporated with the Australian and New Zealand Gazette.]

NZJS .... *New Zealand Journal of Science and Technology*, vol. 1, 1918–Vol. 8, 1925.

OTR .... New Zealand Association of Nurserymen. *Official Trade Register* for 1916.

PAS .... PETRE, HON. HENRY WILLIAM. *An account of the settlements of the New Zealand Company* .... L. 1841

PLC .... PAUL, ROBERT BATEMAN, ARCHDEACON OF WAIMEA. *Letters from Canterbury*, New Zealand .... L. 1857

PMC .... POLACK, JOEL SAMUEL. *Manners and customs of the New Zealanders.* (2 Vols.) .... L. 1840

PNZ .... POLACK, JOEL SAMUEL. *New Zealand: being a narrative of travels and adventures in that country between the years 1831 and 1837.* (2 Vols.) .... L. 1838

POO .... POTTS, THOMAS HENRY. *Out in the open*: a budget of scraps of natural history gathered in New Zealand Chch. 1882

PPO .... PYKE, VINCENT. *The Province of Otago, in New Zealand*, its progress, present condition, resources, and prospects. Published [anonymously] by authority of the Provincial Government .... Dun. 1868

PRNZ .... *Papers relative to the affairs of New Zealand.* Minutes of evidence, etc. Vol. 1 .... L. 1838

PWW .... PAULIN, ROBERT. *The wild West Coast of New Zealand.* A summer cruise in the "Rosa." .... L. 1889

RCP .... RAOUL, M. E. *Choix de plantes de la Nouvelle-Zélande* Paris 1846
[There are several corrupt Maori names in the volume, but these have not been noted, with the exception of cohou-cohou, which is in Hooker.]

RDT .... *Reports on the durability of New Zealand timber in constructive works* .... We. 1875
[Contains three reports, by T. Kirk, J. M. Balfour, and E. W. Ward.]

RHH .... "Roslyn" [pseud. of Margaret Sinclair.] *The Huia's homeland, and other verses* .... L. 1897

RSC .... *Report from the select committee on New Zealand together with the minutes of evidence, appendix and index.* Ordered, by the House of Commons, to be printed, 29th July, 1844.

SAN .... SAVAGE, JOHN, SURGEON. *Some account of New Zealand;* particularly the Bay of Islands, and surrounding country; with a description of the religion and government, language, arts, manufactures, manners, and customs of the natives, etc. .... L. 1807

SLM .... *My New Zealand Garden.* By a Suffolk lady ....Wang. 1902

SPR .... SUTTON, C. S. Progress report of the Plant Records Sub-Committee, *Victorian Naturalist*, vol. 26, 1909.

SSD .... SHORTLAND, EDWARD. *The Southern Districts of New Zealand.* A journal [of a journey during 1843-44] with passing notices of the customs of the Aborigines L. 1851

STT .... COLLINSON, CAPT. T. B., RE. On timber trees of New Zealand. By Capt. Collinson, R.E., with notes by Wm. Swainson, Esq., F.R.S., etc.
[This is Paper 18, in *Papers and proceedings of the Royal Society of Van Diemen's Land,* 1849-51. Dated Feb., 1850, and read 10th July, 1850.]

TCS .... TORLESSE, C. O. The Canterbury Settlement topographically described in a Report to J. R. Godley, Chief Agent of the Canterbury Association, by C. O. Torlesse, Esq., 10th June, 1851. Published by D. M. Aird, 340 Strand, London, from the *Lyttelton Times* of 14th, 21st, 28th June, and 5th July, 1851.

TFF .... THOMSON, GEORGE MALCOLM, F.L.S. *Ferns and fern allies of New Zealand, with instructions for their collection and hints on their cultivation* .... Melb. 1882

THW .... TURNER, E. PHILLIPS. A botanical examination of the Higher Waimarino District. In *Appendices, House of Representatives, N.Z.* Paper C-11, 1909.

TIC .... THOMSON, GEORGE MALCOLM, F.L.S. *Introductory class-book of botany for use in New Zealand Schools* .... We. 1906

TIM .... TAYLOR, REV. RICHARD. *Te Ika a Maui*: or, New Zealand and its inhabitants .... L. 1855

TNC .... TANCRED, SIR THOMAS. Notes on the natural history of the province of Canterbury in the Middle Island of New Zealand. .... Ed. 1856
[Reprinted from *Edinburgh New Philosophical Journal*, New Series, for January, 1856.]

TNN .... THOMSON, GEORGE MALCOLM, F.L.S., F.C.S. *A New Zealand Naturalist's Calendar and notes by the wayside* .... Dun. 1909

Trans. .... *Transactions and Proceedings of the New Zealand Institute.* Vols. 1-56, 1869-1926.

TSN .... THOMSON, ARTHUR S. *The story of New Zealand: past and present—savage and civilised.* (2 vols.) .... L. 1859
[Surgeon-Major, 58th Regiment.]

Ver. (A) Vernacular names, supplied by B. C. Aston, Chief Chemist, Department of Agriculture, collected in various parts of New Zealand.

Ver. (C) Vernacular names, supplied by L. Cockayne.

Ver. (D) Vernacular names, supplied by H. B. Dobbie of Auckland, on 20th November, 1921.

Ver. (WB) Vernacular names, used by early settlers, supplied by W. Best of Otaki, on 29th July, 1919.

Ver. .... Vernacular names heard by author among settlers, sawyers, etc.

VN .... *Victorian Naturalist*, July, 1920.

VTN .... VEITCH, JAMES HERBERT, F.L.S., F.R.H.S. *A traveller's notes, or notes of a tour through India,.... the Australian Colonies and New Zealand during the years 1891-93* .... Chelsea 1896

WAH .... WHITE, JOHN. *The ancient history of the Maori, his mythology and traditions.* (6 vols.)—vol. 6 quoted .... We. 1890

WDS .... WELD, FREDERICK A. *Description of a journey between Lyttelton and Cape Campbell.*
[From 4th Dec., 1850 till end of year.]
Printed in *Lyttelton Times*, 8th March, 1851.

WM .... WESTERWOOD, ELAN. *Maoriana* .... Dun. [1918]
[Mispronunciations and mis-spellings such as manúka, pah, etc.]

WML .... WOHLERS, JOHANN FRIEDRICH HEINRICH. *Memories of the life of J. F. H. Wohlers, Missionary at Ruapuke, New Zealand* [1844-1885.]. An autobiography. Translated from the German by John Houghton .... Dun. 1895

WNZ .... WAKEFIELD, EDWARD JERNINGHAM. *Adventure in New Zealand*, from 1839 to 1844. (2 vols.) .... L. 1845
[Reprint in one volume by Whitcombe and Tombs, Chch., 1908.]

YNZ .... YATE, WILLIAM. *An account of New Zealand, and of the formation and progress of the Church Missionary Society's mission in the Northern Island* .... L. 1835

Z .... "*Zealandia.*" A monthly magazine of New Zealand literature, by New Zealand authors .... Dun. 1889-90
[Only one volume published, July, 1899–June 1890.]

PROCEEDINGS.

PROCEEDINGS

OF THE

NEW ZEALAND INSTITUTE,

1926.

MINUTES OF ANNUAL MEETING OF THE BOARD OF GOVERNORS

HELD IN

Dunedin on the 28th January, 1926.

The annual meeting of the Board of Governors of the New Zealand Institute was held in the Otago University on Thursday, 28th January, 1926 at 10 a.m.

Present—

President, Dr. P. Marshall, and the following governors:—

Representing the Government: Dr. Chas. Chilton, and Mr. B. C. Aston.

Representing the Wellington Philosophical Society: Professor H. B. Kirk.

Representing the Auckland Institute: Professors H. W. Segar, and F. P. Worley.

Representing the Philosophical Institute of Canterbury: Professor C. Coleridge Farr, and Mr. A. M. Wright.

Representing the Otago Institute: Professor Park and Hon. G. M. Thomson, M.L.C.

Representing the Hawkes Bay Philosophical Institute: Mr. H. Hill.

Representing the Nelson Institute: Professor T. H. Easterfield.

Apologies for absence were received from Dr. J. A. Thomson, Mr. M. A. Eliott, Hon. Treasurer, Mr. G. V. Hudson, and Dr. L. Cockayne.

Roll Call.—The Hon. Secretary called the Roll.

Presidential Address.—The President gave his presidential address in the evening at the meeting at which the Science Congress was opened. It was resolved to publish the address in the Transactions.

Notices of Motion.—These were called for and dealt with in their proper places.

Incorporated Societies' Reports and Balance-sheets.—The following reports and balance-sheets were received and were laid on the table: Philosophical Institute of Canterbury, for the year ending 31st October, 1925; Auckland Institute, for the year ending 5th February, 1925; Wellington Philosophical Society, for the year ending 30th September, 1925; Nelson Philosophical Society, for the year ending 31st October, 1925; Hawkes Bay Philosophical Institute, for the year ending 31st December, 1925; Otago Institute, for the year ending 30th November, 1925. It was resolved that the reports be forwarded to the Hon. Treasurer for his perusal and report as to whether they are in order.

Standing Committee's Report.—This was read and adopted.

REPORT OF THE STANDING COMMITTEE FOR THE YEAR ENDING 31ST DECEMBER, 1925.

Meetings.—During the year 9 meetings of the Standing Committee have been held, the attendance being as follows:—Dr. Marshall, 8; Mr. G. V. Hudson, 8; Mr. P. G. Morgan, 8; Dr. J. A. Thomson, 2; Dr. Cockayne, 1; and Mr. B. C. Aston, 5.

Hon. Secretary.—In March the Hon. Secretary, Mr. B. C. Aston, was granted leave of absence in order that he might visit England, and Professor H. B. Kirk kindly consented to act in his place.

Publications.—Volume 56 is not yet out of the printer's hands. The delay has been occasioned by pressure of work in the Government Printing Office, owing especially to the General Elections being held this year, but it is a matter for regret that the publication of the Transactions should be so frequently delayed.

Part 4 of Bulletin 3, Dixon's Bryology of New Zealand, is also in the press.

Hector Award.—The award for 1925 was made to Mr. B. C. Aston for his researches on the chemistry of bush-sickness and of the N.Z. flora. Owing to Mr. Aston's absence in England during the greater part of the year, the medal has not yet been presented to him, but it is hoped that this will be done at one of the meetings of the Science Congress in Dunedin in January.

Exchange List.—Last year a circular was issued to over 200 institutions all over the world, stating that the N.Z. Institute would be glad to consider entering into an exchange of publications. The Library Committee, after considering the replies to this circular, recommended that about 70 of these institutions be added to the Exchange List, some of them being old exchanges resumed. In some cases complete sets of publications have been received from these new exchanges, and in other cases offers have been received to send some back numbers. As far as possible, the Institute is making an equivalent return, which should help to reduce the overstocked volumes of the Transactions. The names of the new exchanges are being printed in Volume 56.

Sales.—There has been a very large increase in the sale of "Maori Art," over £150 being obtained from this source. A number of partial sets of Transactions and some Bulletins sold have also increased the year's revenue.

Incorporated Societies Reports and Balance Sheets.—The following reports and balance sheets have been received and are now laid on the table:—

Philosophical Institute of Canterbury, for the year ending, 31st Oct., 1925
Wellington Philosophical Society, for the year ending 30th Sep., 1925.
Auckland Institute, for the year ending 27th February, 1925.
Otago Institute, for the year ending 30th November, 1925.
Hawkes Bay Philosophical Institute, for the year ending 31st Dec., 1925
Nelson Philosophical Society, for the year ending 31st Oct., 1925.

Fellowship.—The N.Z. Gazette of the 28th May contained a notice to the effect that Professor J. Macmillan Brown, M.A., LL.D. and Te Rangi Hiroa (P. H. Buck), D.S.O., M.D., Ch.B. had been appointed at the Annual Meeting on the 27th January, 1925, to the Fellowship of the New Zealand Institute. In April the incorporated societies were requested to forward nominations for filling the two vacancies for the Fellowship for 1925. Ten nominations were received and were submitted to the Fellows of the Institute for selection. On the 29th September the Hon. Returning Officer announced the names of the first three selected and stated that a tie had occurred for the 4th place. A fresh election for that place was therefore held, and on the 28th October the four names were submitted to the Governors for election at the Annual Meeting.

Carter Library Legacy.—The accumulated interest on the legacy of £50, left by the late C. R. Carter and held by the Public Trustee, has now reached the sum of £100. In order that this fund might increase more rapidly, the interest has been invested in 5½% Inscribed Stock maturing in 1937.

Research Grants.—At a meeting of the Standing Committee held on the 16th March, three applications for research grants, two of which had been held over from last year for further consideration, were granted. These amounts exhausted the research vote of £1,000 for the year 1924-25.

An amount of £1,780 appeared on the Estimates as the vote for research and on the surface it looked as though the research vote had been increased. This, however, was not the case, for, although all last year's vote had been allocated research grantees had not expended their grants to the amount of £780, and this amount had to be revoted by Parliament. An endeavour was made to have the grants paid into the Institute directly they were allocated, but the Department would not agree to do this, and the practice of making progress payments as required in each case is therefore continued by the Department.

On the 1st September, incorporated societies were notified that £1000 was available for research and applications were invited from research workers. The Research Grant Committee considered eighteen applications and recommended that eleven of these be granted. One other application is under further consideration and the remaining six were not recommended.

Reference List of Periodicals.—Mr. Archey, who has compiled the reference list of periodicals, wrote on the 25th November that the List is now completed and ready for publication. It comprises about 30 typed foolscap sheets and it remains to be decided how this list is to be made available to those who require a copy.

Binding.—During the year the following publications have been bound as far as they were complete:—

Royal Society: Transactions and Proceedings.
Bulletins of the Geological Survey of N.Z.
Journal of the Polynesian Society.
Journal of Agriculture, N.Z. Department of Agriculture.

National Research Council.—On the 2nd March in accordance with a resolution of last Annual Meeting, the President wrote to the National Research Councils of Australia, America, Canada, and Japan, notifying them that in New Zealand the New Zealand Institute performs the functions of a National Research Council and is recognised by the N.Z. Government as such.

Finances.—On the 5th February it was resolved that the various Departments whose officers published papers in the last volume of the Transactions should be appealed to for a contribution towards the cost of printing. Accordingly, the Department of Agriculture, the Geological Survey, the Cawthron Institute, and the four University Colleges were approached, with the result that the Geological Survey contributed £60, the Otago University £50 and the Cawthron Institute stated that it would contribute £15 conditionally on the statutory grant not being increased. The other departments were not willing to contribute.

In accordance with a resolution of last Annual Meeting a deputation waited upon the Hon. Minister of Internal Affairs to ask for an increased grant. On the 19th May the President reported that the deputation had been well received. On the 6th October the Under-Secretary for Internal Affairs wrote intimating that the statutory grant had been increased from £1000 to £1500 annually, provision having been made in section 7 of the Finance Act, 1925, which reads as follows:—

"1. The Minister of Finance shall, without further authority than this section, pay to the Board of Governors of the New Zealand Institute the sum of one thousand five hundred pounds in each financial year, beginning on the first day of April, nineteen hundred and twenty-five, to be applied in or towards payment of the general expenses of the Institute.

2. This section is in substitution for section 10 of the New Zealand Institute Act, 1908, and that section and the New Zealand Institute Amendment Act, 1920 are hereby repealed."

Index to the Transactions.—At a meeting of the Standing Committee, held on the 19th May, a letter was received from the Nelson Philosophical Society, recommending that the publication expenses be cut down by discontinuing the printing of the Index. The Auckland Institute wrote, stating that it did not support the Nelson Society's resolution. The Philosophical Institute of Canterbury also wrote stating that, while recognising the great value of the present index, it considered that it could be materially reduced in size by the elimination of specific names and items of non-scientific importance. It felt a simple standardized system of indexing that would be considerably less bulky than at present might be arrived at.

It was resolved that the matter be referred to the Annual Meeting.

Sonic Depth-Finders.—The resolution of last annual meeting that the New Zealand Naval Service be equipped with sonic depth finders was forwarded to the Minister of Marine, who replied that the matter would receive careful consideration.

Geological and Vulcanological Research.—The resolution of last annual meeting that the Government be asked to give effect to the recommendation of the Science and Art Board that a full-time research officer be appointed to make geological and vulcanological observations in the volcanic regions, was forwarded to the Hon. Minister of Internal Affairs, who replied that the matter would receive his consideration.

Catalogue of N.Z. Fishes.—The resolution of last annual meeting, requesting the Government to have a catalogue of the fishes of New Zealand prepared by a qualified expert was forwarded to the Hon. Minister of Internal Affairs, who replied that this was one of the matters on which it was proposed to obtain the views of Mr. A. E. Hefford, who had been appointed to the position of Chief Inspector of Fisheries, after his arrival in the Dominion.

Dominion Museum.—The resolution of last annual meeting, asking that the Government bring in a Bill placing the control of the Dominion Museum and Art Gallery in the hands of a Board of Trustees was also promised earnest consideration by the Hon. Minister of Internal Affairs.

Advisory Board of Astromony and Seismology.—The resolution of last annual meeting that there be set up a Board consisting partly of nominees of the Government and partly of scientific men appointed by the Institute as a Board of Advice for the geo-physical services of the Dominion was forwarded to the Hon. Minister of Internal Affairs. On the 15th June the Under-Secretary wrote, stating that the Minister approved of the Institute's nominating two permanent members of the existing Board. At a meeting of the Standing Committee, held on the 23rd June, Professor Sommerville and Professor C. C. Farr were appointed to represent the Institute on the Board of Advice.

Tongariro National Park Board.—The resolution of last annual meeting was conveyed to the Chairman of the Park Board, who replied that a resolu-

tion had been passed to the effect that the Park Board is of the opinion that the heather now growing in the Park should be eradicated. On the 15th June a protest was received from the Manawatu Philosophical Society in regard to the leasing of parts of the Park to private individuals and the matter was discussed at a meeting of the Standing Committee, held on the 23rd June, when it was resolved that the N.Z. Institute strongly protests against the granting of leases in the Park to private individuals. It was further resolved that the Institute takes strong exception to the introduction of exotic game birds that, according to the press, the Tongariro Sports Club and the Auckland Acclimatisation Society propose to liberate in the vicinity of the Park, and it urges the Government to withhold permission for the introduction. These resolutions were published in the Wellington papers. The Chairman of the Park Board in reply pointed out that the question of prohibiting the introduction of such birds was a matter that was governed by the Animals Protection and Game Act, the provisions of which are administered by the Internal Affairs Department.

The Standing Committee further resolved to ask Internal Affairs to refer all matters in connection with the introduction of plants and animals to an Advisory Board specially constituted for this purpose. The Under-Secretary replied that the introduction of plants was a matter which concerned the Agricultural, State Forests, and Lands Departments. With regard to the question of constituting an Advisory Board to consider matters relative to the introduction of animals, as his Department invariably consulted with the Board of Agriculture through the Agricultural Department as to the desirability or otherwise of authorising the introduction of animals, it was not considered necessary to set up a special advisory board. The Standing Committee decided to refer the matter for further consideration to the Annual Meeting.

Science Congress, 1926.—At a meeting of the Standing Committee, held on the 23rd June, it was resolved that the Annual Meeting be held *pro forma* in Wellington on the 26th January and immediately adjourned to Dunedin to meet on the 28th January. On the 5th August it was resolved that the Science Congress last three days, January 28-30th inclusive and that the organisation be left in the hands of the Otago Institute. It was resolved to grant a request that papers which will be read at the Science Congress be regarded as read before one or other of the incorporated societies and that if so desired by the authors, accepted for publication in the Transactions, but not to be accepted for publication in Volume 57. At a meeting of the Standing Committee held on the 13th October the matter of the duration of the Congress was brought up again for consideration and it was resolved that the meeting be extended by two days if the Otago Institute considered it advisable.

Pan Pacific Science Congress, 1926.—On the 15th April the President of the National Research Council of Japan wrote extending to the N.Z. Institute a most cordial invitation to the third Pan Pacific Science Congress, to be held in Tokyo from October 26th to November 9th, 1926. Copies of the letter of invitation were forwarded together with copies of the Preliminary Announcement to all members of the Board and to the incorporated societies. At a meeting of the Standing Committee, held on the 23rd June, it was decided that the President, Dr. Marshall, should be the Institute's representative on the Organisation Committee of the Pan Pacific Science Congress. It was also resolved that in the opinion of the N.Z. Institute it is desirable that membership of the Pan Pacific Congress should be restricted to countries, and that the National Research Council of each country should solicit the interest and assistance of all institutions in that country, and make such arrangements as may seem most suitable to organise all opinions on matters of moment to the Congress in order that the delegation of the Country should be able to represent all interested scientific opinion of the country at the Congress or on the Organisation Committee of the Pan Pacific scientific organisations. Further it was resolved that recognising that at such meetings as those of the Pan Pacific Congress there is danger that the different sections become too restricted and technical in their dis-

cussions, and that the members of each section may lose touch with those of all other sections, the N.Z. Institute therefore welcomes the proposals of the National Research Committee of Japan to organise general and divisional meetings to take the place in part of sectional meetings at previous gatherings of the Pan Pacific Congress. The subjects selected for discussion at these general and divisional meetings will certainly arouse common interest among those who study widely different branches of science. Such discussions therefore should elicit opinions from many different points of view with much benefit to all who attend them.

Further letters dated 28th July and 3rd August were received from the Secretary of the National Research Council and outlined the extent of the hospitality which it is proposed to accord to delegates. Probably two double fares between Wellington and Tokyo or four single fares will be provided, but this is not definitely settled. Part of the delegates' and their families' hotel expenses in Tokyo will be defrayed and the whole of the expenses of the excursions that are being arranged both before and after as well as during the session. As far as possible cars will be provided for delegates. Great difficulty about accommodation is feared and about 150 will be the maximum total number of delegates and their families that can be conveniently accommodated. The selection of delegates is left entirely to the Institute and direct invitations to any person individually will not be given.

Pan Pacific Science Congress, 1929.—At a meeting of the Standing Committee held on the 13th October, Dr. Marshall reported that matters were in train with regard to a possible invitation to the Pan Pacific Congress to meet in Auckland in 1929.

Advancing New Zealand Time.—A letter was received from Mr. W. A. Harding, of Napier, asking whether the N.Z. Institute would use its influence to have New Zealand time advanced half an hour permanently. It was decided that no action be taken at the present time.

N.Z. Institute of Horticulture.—On the 21st January the N.Z. Institute of Horticulture wrote asking the N.Z. Institute to appoint a representative to act on the Dominion Council of the Institute of Horticulture. Mr. B. C. Aston was appointed and during his absence in England his place was taken by Mr. W. R. B. Oliver.

Committee on Investigating the Temperature, Salinity, etc. of the Pacific Ocean.—In response to a letter from T. W. Vaughan, of the University of California, the President, Dr. Marshall, was appointed to represent New Zealand on the Committee of Salinity which was set up at the Pan Pacific Congress, 1923.

Scenery Preservation Board.—On the 23rd January the N.Z. Tourist League placed before the Minister the following resolution which it had forwarded to the Prime Minister, the Minister of Lands and the Minister in charge of Tourist Resorts:—

> "That, while this League is aware of the good work that has been done in the matter of the preservation of scenery, it is considered that there is still much to be done in this direction, and that in order to further reserve and protect native bush areas and historical sites, a National Conservation Board should be set up, with a more liberal appropriation than at present exists. That this Board include representatives of the Department of Lands, the Forestry Department, the New Zealand Institute and the N.Z. Tourist League."

The Standing Committee strongly approved of the resolution and stated that it would be pleased to hear that the preservation of National Parks was included in the League's programme. A further letter, dated 12th February, was received from the Tourist League, inviting the Institute to express an opinion on the question of urging the authorities to widen the constitution of the Scenery Preservation Board so as to permit some representatives of outside bodies to sit with members of the Board and assist them in their task of selecting sites for preservation. The League suggested that a representative of the Institute and a representative of the Forestry League might act on the Board with advantage to the whole Dominion.

This letter was considered at a meeting of the Standing Committee held on the 29th May, when it was resolved that in the opinion of the Institute it is desirable to widen the membership of the Scenery Preservation Board to include representatives of societies dealing with scientific and historical matters. The resolution was forwarded to the Hon. Minister in charge of Scenery Preservation, who replied that he had carefully noted the resolution passed by the Standing Committee and he should be pleased to give the matter careful consideration should the Government decide to modify the provision of the Scenery Preservation Act, 1908, under which the Scenery Preservation Board is constituted.

Earthquake Prognostication.—Mr. F. R. Field, of Onehunga, in letters of the 19th March and 15th April, placed before the Standing Committee a report of his investigations and it was resolved to ask Mr.. Field for a list of his prognostications for the next twelve months. Further letters were received from Mr. Field and a small committee, consisting of Professor Sommerville and Dr. Adams, was set up to report. The committee considered Mr. Field's claims and stated that it would be willing to report if it received from him a complete statement of the scientific basis of his theory, the facts and the hypotheses and a reasoned discourse explaining his deductions and so far as relevant the inter relations of the various fields in which he claims to have made successful predictions.

On the 30th October Mr. Field reported that he will be glad to do his best to supply the information required. His report has not yet come to hand.

Auckland Islands.—The Standing Committee on the 23rd June resolved to ascertain from the Lands Department if it were true that the Auckland Islands were to be leased as a sheep run. The Lands Department replied that 116,000 acres of the Auckland Islands were under lease to Moffatt Bros. at an annual rental of £40, the date of the expiry being 29th February, 1932. On the 5th August, the Standing Committee resolved to express regret that such a state of things should be possible and that the Government be urged to decide that the lease should not be renewed nor fresh ones granted.

Auckland Museum.—During the year the foundation stone of the Auckland War Memorial Museum was laid and an invitation to the President and Board of Governors was received.

Native Bird Protection.—The Under-Secretary for Internal Affairs advised the Institute on the 18th November that warrants had been issued for the capture of six pukako for transfer to Kapiti Island. It was resolved to inform the Under Secretary that the Standing Committee is surprised to learn that certain protected birds (saddle-backs) have recently been taken from the Hen and Chicken Islands and it would be glad to have further information on the matter. A reply was received stating that Mr. Hamilton, of the Dominion Museum, the caretaker of Kapiti Island, and Captain Sanderson, Hon. Secretary of the Native Bird Protection Society, visited the Hen and Chicken Islands for the purpose of capturing saddlebacks for liberation on some of the island sanctuaries. A number of birds were duly captured and were liberated on Little Barrier and on Kapiti Islands. It is proposed to watch the matter very carefully to ascertain whether the removal of the birds has caused any harm and also whether the transferred birds are doing well in their new habitation and become well established there.

Transactions, Illustrations.—At a meeting of the Standing Committee held on the 23rd June, a letter was received from Mr. W. Martin, Dunedin, asking permission to copy from the Transactions plates for his forthcoming book on Plants and Animals. The matter was referred to the Annual Meeting.

Advertising the Transactions.—When in London, Mr. Aston interviewed the London Agents, Messrs Wheldon & Wesley, Ltd., and this firm suggested

that a prospectus of the Transactions should be printed and circulated by it in order to advertise the Transactions. This matter came before the Standing Committee on Mr. Aston's return and it was resolved that a four page circular be printed, the cost not to exceed £5 to £6. The Hon. Editor undertook the arrangements about the printing.

Library Matters.—With the addition of new exchanges the accommodation in the Library was taxed to its utmost. The Library Committee, therefore, on the 19th May was authorised to expend up to £25 in additional shelving. The only way to do this was to heighten the existing stacks and this was done at a cost of £18. The lighting of the room was badly affected and additional lights were installed at a cost of £5/12/6.

The Hon. Librarian, Professor Sommerville, left in November for England, and during his absence Professor Kirk has kindly consented to act as Hon. Librarian.

Business arising therefrom:—

Institute Library.—Professor Kirk reported that negotiations were pending for obtaining more accommodation for the Institute's Library, and the matter was left in his hands.

Sale of Maori Art.—The matter of altering the price of Maori Art was left to the Standing Committee with power to act.

Reference List of Periodicals.—It was resolved to print or otherwise publish the reference list compiled by Mr. Archey as may be decided by the Standing Committee and the Hon. Editor.

National Research Council.—The matter of joining the National Research Council was ordered to come up later when Sir Frank Heath's visit was discussed.

Science Congress, 1929.—The proposal to hold a congress in Auckland in 1929 was discussed.

Index, Transactions.—The question of the publication of the annual index to the Transactions was left to the Publications Committee.

Report of the Tongariro National Park Representative.—The report was read and, after a discussion, in which the President related his experiences on the Board as representative of the N.Z. Institute, was adopted on the motion of Dr. Marshall, seconded by the Hon. G. M. Thomson.

Tongariro National Park Board.

Report of Representative of N.Z. Institute.

Two decisions of the Board are of special interest to the New Zealand Institute as they may be fraught with considerable bearing on the plant and animal life in the Park. The Board has now definitely decided not to permit anyone to introduce exotic plants or animals without express permission and it has requested those acclimatisation societies which have been permitted to liberate introduced birds to free them as far from the Park as possible.

The Board has decided to cut up a small area on the margin of the Park into small sections that will be leased to private individuals. The

Board has not yet definitely decided on the site on which the hostel should be built, though they have restricted the possibilities to the stretch between the present Whakapapa huts and the bridge near the Haunted Whare.

The Board has carried a resolution that in its opinion the heather should be eradicated.

P. MARSHALL.

Chas. A. Whitney Expedition.—On the motion of Professor Kirk, seconded by Professor Segar, it was resolved that the Department of Internal Affairs be asked, if it is not too late to do so, to send a representative with the Whitney Expedition to supervise the collecting of native birds under the permit which has been issued.

Great Barrier Reef Committee's Report.—The report of the Institute's representative on this committee was adopted.

GREAT BARRIER REEF COMMITTEE.

Eight meetings of the Committee were held during the past year.

Boring Proposals.—The sub-committee appointed to report on the costs and difficulties of boring, furnished a statement giving details regarding the boring required, the estimated cost of purchasing the plant, and the monthly cost of running it. After various suggestions and correspondence, it was finally decided that the tender from the Goldfields Diamond Drilling Co., wherein it undertakes to bore with the calyx drill and chilled shot, be accepted, and that the Mines Department of Victoria be asked for a loan of a complete calyx drilling plant. The Sandbank, Oyster Cay, on the S.W. end of Michaelmas Reef, was agreed to as the site for boring operations, the work not to be commenced until April, 1926.

Investigations.—The scientific director, Mr. Chas. Hedley, was absent on leave for four months, during which time Mr. R. C. Mundell was temporarily appointed to carry on the work. Mr. F. Jardine was employed for a time to examine the Hichinbrok Channel. Mr. G. Stanley will accompany H.M.A.S. "Geranium" on her survey. Mr. P. C. Morrison has been collecting at Yarrabah, near Cairns.

Personnel of Committee.—Sir Matthew Nathan resigned the chairmanship of the Committee, as he was returning to England, and was appointed a Patron. Professor H. S. Richards was appointed Chairman, and Mr. Hedley, Secretary.

Publications.—Thirteen papers were, during the year, published in the Transactions of the Royal Geographical Society of Australasia, Queensland.

Credit Balance in Hand.—£2,328/14/10.

Publication Committee's Report.—This report was read, discussed, and adopted. A letter was read from Messrs. Thos. Avery and Sons, Ltd., New Plymouth (11th December, 1925), giving an estimate for printing the Transactions.

PUBLICATION COMMITTEE'S REPORT.

Volume 56 is not yet out of the printer's hands, though it was promised for June or July of 1925. It is now promised by the end of January. It must be observed that, while these promises are made in good faith by the printer, the Transactions always have to make way for other work; it should not be so, but it is so. There were 66 papers submitted for publication, and, of these, the volume will contain 60 papers by 42 authors, but details of pagination cannot be given, as page proofs have been received only as far as page

224. Owing to the systematic rejection of a certain class of paper during the last two or three years, fewer papers of the kind are now submitted, and rejection becomes a matter of more difficulty, for there are many good workers, and the results of their work should be recorded. It becomes increasingly evident, however, that unless the amount available for printing is augmented, there will have to be even more rigid scrutiny of papers. It may be advisable to enforce the decision of the Institute that in all papers accepted for publication that are more than 30 pages in length, the author be required to bear the cost of all beyond 30 pages, though this will not mean a great deal. In the two parts of the last volume (No. 55) there were only two papers in each part, that is four in all, that exceeded the 30 pages. Some authors had more than one paper, and, including all their papers, there were three authors in each part, that is, six in all, who had more than 30 pages. If these extra pages, 58 in the first part and 71 in the second, or 129 in all, had been charged for, there would have been a saving to the Institute of just on £200. There were 34 papers of 10 pages or under; 47 of 20 pages or under; 53 of 30 pages or under. The total papers numbered 57, so that it will be seen that there were not many unreasonably long papers.

There is another question that might be considered, and that is the publication of the volume in two parts, the first containing lists of new species and like urgent papers, the second the papers whose early publication is not so vital, together with the Annual Report and Appendixes. The cost would be very little more, and there would not be the great delay that the big volume causes.

JOHANNES C. ANDERSEN,
For Publication Committee

Delay in publishing Transactions.—A letter from the Philosophical Institute of Canterbury (5th December, 1925) was read. A letter from the Hon. Editor (9th January, 1926), tendering his resignation, was read. Dr. Farr read a letter from Messrs. Andrew Baty and Co., Ltd., Christchurch (17th December, 1925), giving another tender for publishing the Transactions. On the motion of Mr. Wright, seconded by Dr. Farr, it was resolved that the Standing Committee be instructed to call for tenders under specification for the printing and binding of Volume 57 of the Transactions, and that alternative tenders be called for the issue of the Volume in one, two, or four parts. The Standing Committee shall have authority to accept any tender, not necessarily the lowest, and shall have authority to make such arrangements as it deems necessary for the expeditious publication of the Volume. On the motion of Professor Easterfield, seconded by the Hon. Mr. Thomson, it was resolved that the Board of Governors recommends that the index to the Transactions be continued, but that the indexing be simplified with the object of reducing the cost of publication.

Illustrations from Transactions.—On the motion of Mr. Hill, seconded by Professor Segar, it was resolved that permission be given to Mr. Martin to copy illustrations from the Transactions, subject to the source of origin being stated by the author.

Sir Frank Heath's Visit.—The Hon. Secretary, Mr. Aston, reported the result of his meeting with Sir Frank Heath in London.

It was resolved to wire to the Department of Internal Affairs the following resolution, which was moved by Professor Easterfield and seconded by the Hon. Mr. Thomson, "That, in consideration of the

fact that the New Zealand Institute largely fulfils the functions performed by Boards of Scientific and Industrial Research in other countries, the Board of Governors hereby requests Cabinet to appoint Dr. Marshall, retiring President of the New Zealand Institute, as a member of the Scientific and Industrial Research Committee which is to assist Sir Frank Heath in his forthcoming visit."

Financial.—The Hon. Treasurer's report and the following balance-sheets, which had been duly audited by the Auditor-General, were read, and on the motion of Professor Segar, adopted:—

(*a*) Statement of Receipts and Expenditure.
(*b*) Statement of Assets and Liabilities.
(*c*) Statement of Research Grant Fund.
(*d*) Trust Accounts:—
    (1) Carter Bequest.
    (2) Hector Memorial Fund.
    (3) Hutton Memorial Fund.
    (4) Hamilton Memorial Fund.
    (5) Carter Library Legacy.

HONORARY TREASURER'S REPORT FOR THE YEAR ENDING 31ST DECEMBER, 1925.

The Balance Sheet for 1925 shows a Credit Balance of £263/13/-, as compared with a Debit Balance of £1,122/12/10 in 1924, but the liability for Volume 56 to the Government Printer, which will probably not be less than £1,500, will obviously leave the finances much the same as they were the previous year.

However, it is satisfactory to find that the Statutory Grant has been increased from £1,000 to £1,500 per annum. This will, of course, assist the Institute in meeting the enormously increased cost for printing the Annual Volume, which in 1924 was £1,518, as compared with £334 in 1914. At the same time, as pointed out in my last report, even with this increased grant, the total receipts are not sufficient to cover the expenditure, and, in order to put the finances in a sound position, the cost of printing the Transactions should not exceed £1,000 to £1,200 per annum. Every effort should be made to get the grant increased to £2,000.

The various Trust Accounts are in a very satisfactory condition. The Carter Bequest capital now stands at £6,055, showing a net increase of £301 for the year. This is after transferring £97/4/9 to the Carter Legacy Account for building room. With reference to this transfer, probably a little explanation is necessary. The original legacy was £50, which was deposited with the Public Trustee, and is still held by him. The interest on this £50, from the date deposited up to the year 1921, was included by the Public Trustee in other payments for interest on the Carter Bequest Capital, which prior to the year 1921 had also been invested in the Public Trust Office. It was considered that the interest on this £50 did not rightly belong to the Carter Bequest, but should have been credited to the Carter Legacy Fund. The compound interest for the period amounted to £97/4/9 and a transfer of the amount was accordingly made. The Capital of the Carter Library Legacy Fund is now £153/0/7, made up as follows:—£50 in the hands of the Public Trustee, bearing interest at 5% p.a.; £100 in N.Z. Government Inscribed Stock, bearing interest at 5½% p.a.; £3/0/7 held by N.Z. Institute.

The Hutton Memorial Fund has increased from £1.095/8/5 to £1,155/6/1. With regard to the Hector Memorial Fund, I consider that the annual prize could now be increased to £60.

The books and accounts have been excellently kept by the Assistant Secretary.

M. A. ELIOTT,
Honorary Treasurer.

New Zealand Institute.—Statement of Receipts and Expenditure for the Year ending 31st December, 1925.

Receipts.

	£	s.	d.
Balance as at 31st December, 1924	1,694	2	9
Statutory Grant	1,500	0	0
Contributions printing expenses	110	0	0
Levy, Vol. 55, incorporated societies	176	15	0
Publications sold	193	3	10
Author's Reprints sold	22	15	7
Research Grants from Internal Affairs	284	1	3
P.O.S.B. Interest	47	11	10
Carter Bequest Interest	343	15	0
Hector Memorial Fund Interest	68	10	0
Hutton Memorial Fund Interest	58	10	0
Hamilton Memorial Fund Interest	2	5	0
Endowment Fund Interest	15	0	0
Hamilton Memorial Fund: War Bonds paid	50	0	0
Carter Library Legacy Interest	2	0	10
Carter Bequest transfer to Bank of N.Z.	59	6	5
Hutton Memorial Fund transfer to Bank of N.Z.	69	0	0
	£4,696	17	6

Expenditure.

	£	s.	d.
Government Printer	1,250	0	0
Library Shelving and Lighting	23	12	6
Binding	40	17	7
Travelling Expenses	51	16	10
Salary	300	0	0
Charges (Insurance, Bank Com. etc.)	4	15	0
Research Grants	441	11	11
Petty Cash (Postages, etc.)	19	11	3
Hector Prize, 1925	45	0	0
Carter Bequest Interest Invested	300	6	5
Hutton Memorial Fund Interest Invested	100	0	0
Carter Library Legacy Interest Invested	100	0	0
Endowment Fund Interest Invested	198	17	8
Trust Funds to Accounts P.O.S.B.	82	10	3
Balance as under	1,737	18	1
	£4,696	17	6

	£	s.	d.	£	s.	d.
Balance in Bank of N.Z.	158	6	5			
Less Unpresented Cheque	50	0	0			
				108	6	5
Balance Post Office Savings Bank				1,622	3	0
Petty Cash in Hand				7	8	8
				£1,737	18	1

Made up as follows:—

	Dr.			*Cr.*		
Library Fund				189	13	1
Government Printer				786	11	5
Research Grant Fund				548	17	11
Sundry Debtors	35	19	7			
Balance on Year's Work				263	13	8
Hector Memorial Fund Revenue Account	3	11	8			
Hutton Memorial Fund Revenue Account				41	0	3
Hamilton Memorial Fund Revenue Account				3	14	7
Hamilton Memorial Fund Capital Account				48	7	11
War Bonds Account				1	8	2
Carter Library Legacy Revenue Account				3	0	7
Carter Bequest Revenue Account				31	0	4
Endowment Fund Revenue A/c.	1	0	1			
Carter Bequest P.O.S.B. Account	25	10	1			
Hector Memorial Fund P.O.S.B. Account	15	18	4			
Hutton Memorial Fund P.O.S.B. Account	41	0	3			
Hamilton Memorial Fund P.O.S.B. Account	53	14	7			
Carter Library Legacy P.O.S.B. Account	2	15	3			
Balance as at 31st December, 1925	1,737	18	1			
	£1,917	7	11	£1,917	7	11

New Zealand Institute.—Statement of Assets and Liabilities as at 31st December, 1925.

Liabilities.	£	s.	d.
Carter Bequest Capital Account	6,055	1	4
Hector Memorial Fund Capital Account	1,184	18	1
Hutton Memorial Fund Capital Account	1,114	5	10
Hamilton Memorial Fund Capital Account	48	7	11
Carter Legacy Capital Account	100	0	0
Endowment Fund Capital Account	397	17	0
Carter Bequest Revenue Account	31	0	4
Hutton Memorial Fund Revenue Account	41	0	3
Hamilton Memorial Fund Revenue Account	3	14	7
Hamilton Memorial Fund War Bonds Balance	1	8	2
Carter Library Legacy Revenue Account	3	0	7
Government Printer	786	11	5
Government Research Grants	548	17	11
Library Fund	189	13	1
Balance of Assets over Liabilities	263	13	8
	£10,769	10	2

Assets.	£ s. d.	£ s. d.
Inscribed Stock		7,568 2 11
P.O. Inscribed Stock		1,283 19 4
Hector Memorial Fund Revenue Account		3 11 8
Endowment Fund Revenue Account		1 0 1
Petty Cash in Hand		7 8 8
Cash in Bank of N.Z.	158 6 5	
Less Unpresented Cheque	50 0 0	
		108 6 5
Cash in P.O.S.B.		1,622 3 0
Cash in Carter Bequest Account		25 10 1
Cash in Hector Memorial Fund Account		15 18 4
Cash in Hutton Memorial Fund Account		41 0 3
Cash in Hamilton Memorial Fund Account		53 14 7
Cash in Carter Library Legacy Account		2 15 3
Sundry Debtors		35 19 7
		£10,769 10 2
By Balance		£263 13 8

Examined and found correct—J. H. FOWLER, Deputy Controller and Auditor-General.

NEW ZEALAND INSTITUTE.—GOVERNMENT RESEARCH GRANTS FOR YEAR ENDING 31ST DECEMBER, 1925.

			Dr. £ s. d.	*Cr.* £ s. d.
Jan.	1	By Balance		706 8 7
Feb.	17	„ Treasury		10 0 0
Feb.	17	„ Treasury		56 4 8
April	1	„ Treasury		10 0 0
April	1	„ Treasury		18 0 0
April	18	„ Treasury		5 6 11
Aug.	20	„ Treasury		100 0 0
Aug.	20	„ Treasury		20 16 10
Dec.	3	„ Treasury		3 12 10
Dec.	3	„ Treasury		50 0 0
Dec.	3	„ Treasury		10 0 0
Jan.	27	To Mr. H. J. Finlay	9 2 0	
Feb.	21	„ Prof. Burbidge	25 0 0	
Feb.	21	„ Mr. L. J. Wild	4 2 0	
Feb.	21	„ Dr. Malcolm	5 16 2	
Feb.	21	„ Dr. C. C. Farr	56 4 8	
Feb.	21	„ Dr. C. C. Farr	9 15 2	
Mar.	18	„ Dr. Malcolm	10 0 0	
Mar.	18	„ Dr. Inglis	10 0 0	
Mar.	18	„ Mr. W. J. Phillipps	18 0 0	
April	24	„ Dr. C. C. Farr	5 6 11	
May	20	„ Prof. Worley	10 0 0	
May	21	„ Mr. R. S. Allan	10 0 0	
June	26	„ Dr. C. C. Farr	3 12 10	
Aug.	10	„ Mr. L. M. Isitt	90 0 0	
Aug.	10	„ Mr. R. M. Laing	20 16 10	
Sep.	17	„ Dr. Malcolm	15 8 8	
Aug.	10	„ Mr. H. J. Finlay	15 0 0	
Nov.	25	„ Mr. H. J. Finlay	10 16 8	
Nov.	25	„ Prof. Speight	52 10 0	
Dec.	10	„ Mr. H. Hill	50 0 0	
Dec.	10	„ Dr. Inglis	10 0 0	
Dec.	10	„ Balance	548 17 11	
			£990 9 10	£990 9 10
		Balance	548 17 11	

New Zealand Institute Trust Accounts.

Carter Bequest Revenue Account for the Year ending 31st December, 1925.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To Interest invested in P.O. Inscribed Stock	100	6	5	By Balance	82	11	6
Interest invested in Govt. Inscribed Stock	200	0	0	Interest on investments	343	15	0
Interest transferred to Carter Legacy A/c.	97	4	9	Interest P.O.S.B.	2	5	0
Balance	31	0	4				
	£428	11	6		£428	11	6

Hector Memorial Fund Revenue Account for Year ending 31st December, 1925.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To Balance	27	13	8	By Interest on investment	68	10	0
Hector Prize, 1925	45	0	0	Interest P.O.S.B.		12	0
				Balance	3	11	8
					£72	13	8
To Balance							

Hutton Memorial Fund Revenue Account for the Year ending 31st December, 1925.

Dr.		s.	d.	*Cr.*	£	s.	d.
To Interest Invested in Inscribed Stock	100	0	0	By Balance	80	2	7
Balance	41	0	3	Interest on investments	58	10	0
				Interest P.O.S.B.	2	7	8
	£141	0	3				
				By Balance			

Hamilton Memorial Fund Revenue Account for the Year ending 31st December, 1925.

Cr.	£	s.	d.
By Balance	1	9	7
Interest on War Bonds	2	5	0
	£3	14	7

Carter Library Legacy Revenue Account for the Year ending 31st December, 1925.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To Interest invested in Inscribed Stock	100	0	0	By Balance	3	15	0
Balance	3	0	7	Interest from Public Trustee	2	0	10
				Interest transferred from Carter Bequest	97	4	9
	£103	0	7		£103	0	7

Research Grant Report.—The report of the Research Grants Committee was received and adopted. On the motion of Mr. Hill, seconded by Professor Park, it was resolved, subject to Professor Speight's approval, to forward his report on the geology of the Malvern Hills to the Minister of Mines, with the request that he favourably consider the publication of the report as a Bulletin of the Department.

Report of the Research Grant Committee.

On assuming office the Committee found that two applications had not been decided upon. These were considered in February and recommendations were made for two grants amounting to £115.

As there was still available a balance of £150 from the grant for 1924, which would be withdrawn if not allocated before the 31st March, 1925, additional applications were asked for to reach the Committee not later than the 14th March. Two applications, amounting to £150, were received and recommended and the Committee's work with the 1924 grant was thus completed.

At the 1925 session of Parliament £1,780 was authorised for Research Grants, viz. £1,000 for fresh grants and £780 for grants already allocated but not expended. Applications were asked for to be sent in before October 31st, 1925. Eighteen applications for a total amount of £1,310 were received. These were considered, and on November 17th the Committee made recommendations in favour of nine grants, amounting in all to £655, and on December 10th, after further inquiries had been made, two other applications, amounting to £125, were recommended. One application for a grant of £50 is still under consideration, pending the receipt of further information. In the remaining six cases the Committee has been unable to recommend the granting of the amounts asked for. The balance of the 1925 grant not yet allocated is £220, and there is also available the sum of £188/16/6 in the Research Fund Account, arising from grants that have been refunded. The Committee recommends that applications be invited for an early date so that allocations from these funds may be made before March 31st, 1926.

The Committee suggests that a list of all instruments, apparatus, books, etc. the property of the Institute purchased by research grant funds, be prepared for the information of members.

Abstracts of the reports made by grantees, kindly prepared by the Assistant Secretary, are appended. Mr. A. M. Wright recommends that the unexpended balance of about £15 from his grant be transferred to Professor Malcolm, who has a small grant for a similar research, and the Committee recommends that this be done.

Chas. Chilton, Chairman.

Research Grant Report for the Year ending 31st December, 1925.

Dr. H. H. Allan, who, in 1923, was granted £30 through the Philosophical Institute of Canterbury for cocksfoot and ryegrass investigations, reported on the 15th December, 1925, that the research has been continued on the same lines as last year and certain results are now being prepared for publication. Final results will not be available for some time, but investigations can be carried on without any further grant.

Material from America is not available owing to the restrictions on export of seeds. Considerable attention is being paid to the analysis of the various forms of both species under investigation and living examples have been collected from a number of New Zealand sources. The relationship, in various strains, of germinative energy to subsequent vigour of plants is being investigated. Wild hybrids between Italian and perennial ryegrasses have been collected and are under observation. The balance in hand, £9/16/6, will be expended during the year.

Dr. H. H. Allan, who, in 1924, was granted £50 through the Philosophical Institute of Canterbury for silvicultural investigations on Mt. Egmont, re-

ported on the 15th December, 1925, that this investigation was commenced in August, 1925, when the forests of the northern area were studied and a preliminary ecological classification made. Special attention was paid to the cryptogamic flora and its relationship to the dominant growth-forms. Help was received from Mr. H. N. Dixon, of Northampton, England, and Dr. Du Rietz, of Uppsala University. The first publication of results is being prepared. The investigations will be continued next year, when the balance in hand, namely £16/19/4, will be expended.

Mr. G. Brittin, who, in 1919 was granted £100 through the Philosophical Institute of Canterbury for research on fruit tree diseases, reported on the 23rd November, 1925, that the usual work of pruning, spraying and cultivation has been carried out during the year but was somewhat delayed by an abnormally wet Spring. No alteration has been considered necessary in regard to spraying routine, as the result of last season's work was very satisfactory, there being less than one per cent. of disease present and the fruit reached the market in perfect condition. Considering the numerous complaints of "Brown Rot," not only from nearby orchards, but from many parts of the country, this is eminently satisfactory and that no infection took place during transit is evidently due to the fact that each peach was wrapped in paper when packed. Part of a block of young peaches was sown down in blue lupin which was ploughed in early in Spring and afterwards well limed. The trees are coming away well and are looking very healthy Grantee has in hand £10/17/3 and he relinquishes £80 of this grant.

Mr. R. S. Allan, who, in 1924 was granted £40 through the Otago Institute for research on the Chatham Islands Rocks, reported on the 2nd August that he has spent two months in field work in that area and investigated the whole of Pitt Island also the South East Island, and revisited the north of the Main Island and examined for the first time the rugged southern volcanic plateau. During his survey he was able to make new observations on physiography, structure and general stratigraphy. He collected a large series of rock specimens, mostly of volcanic rocks, and many new and interesting fossils, both molluscan and brachiopoda. The first part of the final report on the "Physical Features and Structure of the Chatham Islands" is completed and in the hands of Mr. H. D. Skinner, who is editing the results of the Expedition. The second report, dealing with detailed stratigraphy, geological history, bibliography, etc., and containing fossil lists, will be ready by the end of the year. Mr. Allan proposes to make an extensive study of the petrology of the volcanic rocks of the Chathams at Cambridge University, and his further report will be submitted later. The whole of the grant has been expended.

Dr. K. M. Curtis, who, in 1920, was granted £100 through the Nelson Institute for research in parasitic mycology, reported on the 15th December that the results of the investigation will be presented in a paper to be read at the Science Congress in Dunedin. The whole of the grant has been expended.

Mr. W. C. Davies, who, in 1921, was granted £50 through the Nelson Institute for research on soil bacteria and protozoa, reported on the 19th December, that work on the bacteriology of certain poor soils of the Nelson District had been continued during the year, further pot experiments and bacterial cultures and counts being carried out with a view to ascertaining (a) the presence or absence of bacterial life; (b) the conditions necessary for the improvement of the soil micro-flora, and (c) the effect of such improvement on the growth of crops in these soils. The experimental work is still in progress, and the results cannot be published until they have been verified by further observations. The whole of the grant has been expended.

Dr. H. G. Denham, who, in 1925, was granted £115 through the Philosophical Institute of Canterbury for research on the low temperature carbonisation of brown coals, reported on the 26th November that the grant had proved insufficient to tempt a qualified graduate to undertake the work. He had arranged with Mr. M. Barak, B.Sc., to start work in February next, but owing to Mr. Barak's recent appointment as Rhodes Scholar, he will probably not be able to carry on the work. Dr. Denham hopes that by next November an assistant will be available. £15 has been spent in literature.

Professor T. H. Easterfield, who, in 1921 was granted £200 through the Nelson Institute for experiments on cool storage of fruit, reported on the 21st December that much additional information has been obtained during the year by means of a special experimental chamber erected within the cool stores of the Nelson Freezing Co. A second interim report has been published as a Cawthron Institute Bulletin by Messrs. McLelland and Tiller. The whole of the grant has been expended. With the additional grant of £100, made at last meeting of the Standing Committee, the work will be continued in 1926.

Dr. C. C. Farr, who, in 1921 was granted £75 (£60 being subsequently transferred to another grant) through the Philosophical Institute of Canterbury for investigations on gas-free sulphur, reported on the 26th November that work has been continued and progress made. The advance has not been rapid but it is hoped that some conclusive results from the investigation will shortly be reached. No expenditure has been incurred during the year, and the balance remains at £4/18/1.

Dr. C. C. Farr, who, in 1924 was granted £250 through the Philosophical Institute of Canterbury for research in Helium in New Zealand, reported on the 26th November that work has been carried on actively during the year. The glass work is all ready, and has been subjected to preliminary tests with satisfactory results. Inquiries have been received from New South Wales and Western Australia and it is hoped that arrangements may be made for testing gases from these States as well as from New Zealand. A new compressor, for the production of more liquid air than was formerly possible, is under order. The compressor, which is being obtained by Canterbury College for the general purposes of the Laboratory, will greatly help in the particular investigation under report. As soon as this compressor arrives everything is in readiness for quickly testing gas effusions. The expenditure to date is £65/4/5.

Dr. C. C. Farr, who, in 1923, was granted £30 through the Philosophical Institute of Canterbury for a research on the relationship between radium emanation and goitre, reported on the 26th November that Mr. Rogers, who has been carrying on this work, read a paper on the results of his analyses of the waters for Radon and for Iodine before the Philosophical Institute of Canterbury. It is hoped that the paper will be published in the next volume of the Transactions of the N.Z. Institute. This paper stirred up considerable interest and has been responsible for inducing the Christchurch Hospital authorities to continue investigations upon similar lines. An expenditure of £9/15/2 has been incurred.

Mr. H. J. Finlay, who, in 1923, was granted £100 through the Otago Institute for research on the tertiary mollusca, reported on the 1st December that he has been occupied in the examination and determination of both living and fossil forms, chiefly with the large and important family of the Turridae, a thesis on the New Zealand members of which he hopes to present for the D.Sc. degree. Delay has occurred through difficulty in obtaining comparative material from Australia but considerable progress is now being made. A good deal of time has been spent on the study of Austalian shells in regard to their relations with New Zealand shells. Papers have been submitted to the editor of the Transactions. The expenditure to date is £62/0/6.

Mr. F. W. Foster, who, in 1923, was granted £25 for collating the notes, etc., of the late Sir David Hutchins on Forestry in New Zealand, reported on the 15th December that, although he has been unable to make the progress during the year which he had anticipated, the first section of the native forests and forest trees has been quite completed as far as compiling and typing goes and some definite progress has also been made on the section on exotic trees and plantations, which section should not take so long, as the author seems to have completed a good deal of this section. The last part of the section on native trees, viz., the rate of growth, has taken up most of the time. The author had commenced writing it up, but Mr. Foster found very many fresh measurements taken by the author in 1920 and requiring to be incorporated in his earlier work, and new averages to be computed. £3 has been expended.

Mr. H. Hill, who, in 1925, was granted £50 through the Hawkes Bay Philosophical Institute for completing a survey of the Taupo Plains, reported on the 8th December that he has made arrangements for going into the Kaingaroa and Taupo Plateau country early in January. So far no expenditure has been incurred.

Professor J. K. H. Inglis, who, in 1923, was granted £25 and later an additional £20 through the Otago Institute for research on the essential oils of native plants, reported on the 8th December that the work has been continued and several plants have been investigated, the large still purchased last year being used for the continuation of the work on the oil from Manuka (*Leptospermum scoparium*) by R. Gardner, M.Sc., and a further paper, embodying his results has been sent to the Society of Chemical Industry, London, for publication. Further quantities of the oil from the Ngaio (*Myoporum laetum*) were extracted and forwarded to Mr. McDowall for completing the research. Work has commenced on *Dacrydium biforme* and on black pine (*Podocarpus spicatus*). The expenditure to date is £33/2/6

Capt. L. M. Isitt, who, in 1925, was granted £100 through the Philosophical Institute of Canterbury for Upper Air research, reported on the 24th November that it has taken some considerable time to locate and order the necessary supplies and instruments. He has had an anemometer and barograph installed at the Aerodrome, these instruments being borrowed from the Meteorological Department. The United States Weather Bureau is also sending some apparatus and supplies on loan. A balloon theodolite is on order from London and he is negotiating for supplies of oxygen from Dunedin or Melbourne. Expenditure amounts to £12/9/0.

Professor R. Jack, who, in 1917, was granted £25 through the Otago Institute for investigations on the electric charge on rain, reported on the 9th December that the cathode-ray osscillograph has been used this year on a research on some electrical properties of osglin neon lamps and a paper on this work will be read at the Science Congress in Dunedin. As the osscillograph has a working life of only 200 hours, its usefulness is now almost at an end. The whole of the grant has been expended.

Mr. F. V. Knapp, who, in 1925, was granted £25 through the Nelson Institute for a research on Maori artifacts, reported on the 15th December that, owing to the wet weather of last summer and autumn, he was unable to proceed with the work, but hopes to commence early in the year. No expenditure has been incurred.

Mr. R. M. Laing who, in 1924, was granted £100 through the Philosophical Institute of Canterbury for research on New Zealand algae, reported on the 7th December that he has written a paper entitled "A Reference List of N.Z. Marine Algae" which he read before the Philosophical Institute of Canterbury. A second and shorter paper entitled "External Distribution and Relationships of the N.Z. Seaweeds" will be read at the Science Congress in Dunedin. Collections have been made at various places and a considerable amount of work done on his herbarium specimens. The expenditure amounts to £25/2/8.

Professor J. Malcolm, who, in 1919, was granted £250 and subsequently £175 through the Otago Institute for research on the food value of N.Z. fish, reported on the 15th December that he has continued work on the vitamins in fish and the results will be published as paper 7 of the series in the Transactions of the N.Z. Institute on the vitamins in the Tarakihi. This fish provides a valuable source of vitamin A and the vitamin was found to be to a very large extent resistent to heating, drying, refrigerating and predigestion. These results indicate that this would be a suitable fish for canning. It is already justly prized when smoked. Expenditure during the year has amounted to £33/13/5.

Professor J. Malcolm, who, in 1918, was granted £30 through the Otago Institute for research on the pharmacology of N.Z. Plants, reported on the 15th December that a balance of about £10 remains in his hands and that he hopes to find someone to complete the work.

Dr. Marsden, who, in 1924, was granted £60 through the Wellington Philosophical Society for seismological research, reported on the 1st Decem-

ber that he had no report to make. No portion of the grant has been expended.

Mr. J. G. Myers, who, in 1925, was granted £10 through the Wellington Philosophical Society for research on N.Z. Hemiptera, reported on the 27th July that a paper on the biology of the N.Z. Heteroptera had been submitted for publication in the Transactions before he left for America. The work now in progress on the Homoptera will be a much bigger work, but he hopes to have a paper on the Cicadidae in the next Transactions. While in Europe he examined and revised thoroughly all the types of N.Z. Homoptera in European collections in so far as they are at present available. This much needed work will obviate all further confusion so far as these species are concerned. The grant has been expended.

Mr. F. H. McDowall, who, in 1924, was granted £60 through the Otago Institute for an investigation of Ngaio Oil, reported on the 8th August that a paper, embodying most of the results, was read before the Chemical Society of London on the 8th June and has been accepted for publication in the Journal of that Society. Later Mr. McDowall forwarded a reprint of his paper. The whole of the grant was forwarded through Internal Affairs to the High Commissioner and Mr. McDowall has so far expended £20/11/5.

Mr. W. J. Phillipps, who, in 1924, was granted £30 through the Wellington Philosophical Society for research on the life-history of N.Z. fishes, reported on the 20th November that partly as a result of the grant received, he is writing a book on the fresh water fishes of New Zealand and it is nearing completion. Partial results of the investigation are published in preliminary descriptions of New Zealand eels in vol. 8, N.Z. Journal of Science & Technology with plates; the river flounder, and the N.Z. minnow in vol. 7 of the same publication. The expenditure so far is £7/5/3.

Professor R. Speight, who, in 1919, was granted £225 through the Philosophical Institute of Canterbury for a geological Survey of the Malvern Hills, forwarded on the 11th December a detailed report of 200 typed pages and maps of his work complete to date. The report includes that from Mr. Page on the chemical and physical properties of the clays as well as sections illustrative of the report and also a panoramic sketch of the locality. The report will not be quite complete until the results of some analyses of igneous rocks have been received from the Dominion Laboratory. These should be available in March when they will be added to the report. Expenditure to date is £133/12/9.

Mr. L. J. Wild, who, in 1923, was granted £25 through the Philosophical Institute of Canterbury for soil survey work in the Manawatu District, reported on the 21st December that during the year work has been carried on as far as opportunity has offered. Two lines have been developed (1) the collection of data relating to soils of the particular district under examination, and (2) the collection and examination of material and data bearing on the general question of soil survey methods. A paper, embodying some results, will be presented to the Science Congress in Dunedin. The expenditure incurred amounts to £2/12/6.

Professor F. P. Worley, who, in 1923, was granted £25 through the Auckland Institute for a research on the chemistry of essential oils of native plants, reported on the 12th December that the investigations on the essential oils of *Leptospermum scoparium*, commenced by Mr. Inder, have been continued by Mr. Short, and are almost complete. The results will be published early next year. Essential apparatus, which could not be procured with the small grant, has been obtained otherwise. The expenditure from the grant is £19/7/0.

Mr. A. M. Wright, who, in 1921, was granted £75 through the Philosophical Institute of Canterbury for research on the vitamin content of commercial meat products, reported on the 31st December that the investigations have been continued in the laboratory of the N.Z. Refrigerating Co., Ltd. and have been concerned chiefly with those vitamins which are supposed to be necessary for reproduction and which exert a specific growth promoting influence upon certain micro-organisms. The expenses incurred have been borne by the N.Z. Refrigerating Co., Ltd., and Mr. Wright requests that the unexpended balance of the grant, namely £25, be revoted to Professor Malcolm for the purpose of furthering his investigations upon the vitamin

contents of fish products, since further expenditure for the purpose of investigation of commercial meat products will be met by the N.Z. Refrigerating Co., Ltd.

Notices of Motion:—

1. A series of proposed amendments to the fellowship regulations were circulated in the name of Dr. J. A. Thomson. On the motion of Mr. Wright, it was resolved that the proposals be circulated to the incorporated societies, and their replies submitted with the proposals to the next Annual Meeting.

2. On the motion of Dr. Farr, seconded by Professor Worley, it was resolved that the question as to how far the New Zealand Institute fulfils the functions of the National Research Council be discussed with Sir Frank Heath, the Standing Committee, and Dr. Marshall.

3. On the motion of Dr. Farr, seconded by Mr. A. M. Wright, it was resolved that the fact of Japan issuing two full passages, or four half passages, be notified to the incorporated societies, with a view to ascertaining the names of those who wish to attend the Pan Pacific Conference.

4. On the motion of Professor Chilton, seconded by Dr. Farr, it was resoved that the question of the Pan Pacific Congress, 1929, be left in the hands of the Standing Committee to take such action as it thinks fit.

It was resolved that the Hon. Secretary ascertain from the A.A.A.S. Secretary the extent of assistance given by the Australian authorities (Government and otherwise) to the Pan Pacific Congress in Australia in 1923.

5. On the motion of the Hon. Mr. Thomson, seconded by Dr. Farr, it was resolved that the Board of Governors of the New Zealand Institute at its Annual Meeting expresses its regret that the Government should have leased a large area of Auckland Islands for the purposes of a sheep-run. The monetary gain is infinitesimal, while the probably damage to animal life and vegetable life is very great.

New Zealand Institute Science Congress.—Professor Segar gave the meeting a preliminary invitation to hold the next Science Congress of the Institute in Auckland.

Fellowship Election, 1926.—The election for two fellows was held, and resulted in the election of Professor W. N. Benson and Dr. J. S. Maclaurin.

Hector Award, 1926.—The report of the Hector Award Committee (Mr. Elsdon Best, Dr. Benham and Dr. J. A. Thomson) was then opened by the President and read. The report, which was adopted, recommended that the Hector Award and Medal be made to Mr. H. D. Skinner, Dunedin.

Hamilton Award, 1926.—The Hamilton Award Committee (Drs. Marshall, Chilton and Tillyard) reported that two of the candidates, both well deserving of the prize, were so nearly equal that they were

unable to distinguish between them. They therefore recommended that the prize be divided between Mr. H. J. Finlay and Dr. J. Marwick, equal. The report was adopted.

Hon. Members' Election.—A ballot for the election of the only vacancy in the Hon. Membership resulted in the election of Dr. Lotsy.

Deceased Honorary Members.—It was announced that the following Honorary Members had recently died:—Dr. Botting Hemsley, Professor Haswell, Dr. A. Dendy, and Dr. Beddard. It was resolved to send a letter of condolence to Mrs. Dendy.

Carter Bequest.—Correspondence dated 18th January, 1926, from Dr. Adams was read and referred to the Standing Committee to report to next Annual Meeting.

The following officers were elected for 1926:—President, Mr. B. C. Aston; Hon. Secretary, Dr. P. Marshall; Hon. Treasurer, Mr. M. A. Eliott; Hon. Editor, Mr. J. C. Andersen; Hon. Returning Officer, Professor H. W. Segar; Hon. Managers Trust Accounts, Mr. B. C. Aston and Mr. M. A. Eliott; Hon. Librarian, Professor Sommerville.

Library Committee.—Re-elected, Professors Sommerville, Kirk, Cotton and Dr. Thomson.

Hector Award Committee.—Dr. Marshall and Professor Speight.

Publications Committee.—The Hon. Editor and the Standing Committee.

Research Grants Committee.—Re-elected, Drs. Chilton, Farr, Hilgendorf, Professor Speight and Mr. A. M. Wright.

Next Annual Meeting.—It was resolved to hold the next annual meeting at Wellington on the last Thursday in January, 1927.

Votes of Thanks to the President for his work for the last two years, to the University of Otago for the use of their buildings for the meeting and for the Science Congress meetings, to the Otago Institute and its officers for their work in organising the Congress, to the Hon. Editor and Hon. Secretary for their labours during the year, to Miss Wood for her work and assistance at the meeting and to the press for its attendance were carried. On the motion of the Hon. G. M. Thomson, seconded by Professor Kirk, a special vote of thanks was proposed and unanimously carried to the Hon. Mr. Bollard, Minister of Internal Affairs, for his sympathy and practical assistance given at a critical time in the history of the Institute.

Travelling Expenses.—It was resolved that the travelling expenses of members of the Board and of the Assistant Secretary attending this annual meeting be paid.

MINUTES AND PROCEEDINGS OF THE THIRD SCIENCE CONGRESS OF THE NEW ZEALAND INSTITUTE.

Held in Dunedin at the University Buildings, January 28—February 1, 1926.

EXECUTIVE COMMITTEE OF CONGRESS.

President of the Congress: The President of the N.Z. Institute; Council of the Congress: The Board of Governors of the N.Z. Institute, acting in conjunction with the Council of the Otago Institute.

Local Hon. Secretary: The Rev. Dr. J. E. Holloway, The Botany Laboratory, Otago University Museum. Private 'Phone 9471.

OFFICERS AND COUNCIL OF OTAGO INSTITUTE.

President: Mr. Wm. Martin, B.Sc.; Vice-Presidents: Mr. J. C. Begg, F.R.A.S.; Mr. H. D. Skinner, B.A. (N.Z. and Cantab.) Dip. Anthy. Camb.

Hon. Secretary: Rev. Dr. J. E. Holloway, F.N.Z. Inst. Hon. Treasurer: Mr. S. Angell. Hon. Librarian: Mr. H. D. Skinner. Hon. Auditor: Mr. W. D. Anderson.

COUNCIL.

Dr. W. N. Benson, B.A. (Cantab.), F.G.S.; Dr. J. K. H. Inglis, M.A., F.I.C.; Dr. J. Malcolm; Prof. J. Park, F.G.S., F.N.Z. Inst.; Mr. J. Crosby Smith; Hon. G. M. Thomson, and Mr. W. J. Williams.

GENERAL MEETING OF MEMBERS.

A preliminary meeting of all members of Congress was held at 11 a.m. on Thursday, January 28, in the Physics Lecture Room, for the purpose of receiving notices.

Notices re such general matters as Badges, printed programme of Congress, Secretary's Office, Notice Board, Men's and Women's lounge and retiring rooms, etc., were given out by the Congress Secretary.

It was announced that the University Club had kindly offered privileges of membership to visiting delegates. Readers of papers were asked to prepare abstracts of their papers for the Press, to be handed in at the Secretary's office. It was stated that the Editors of the "Journal of Science and Technology" were willing to publish those Congress papers which were not of too technical a nature. Secretaries of Sections were asked to take minutes of their sectional meetings for incorporation in the Congress minute book. The invitation from the Rev. Dr. Merrington and the Church Officers of the Presbyterian First Church for Members of Congress to be present at the Sunday evening service was announced.

A preliminary announcement was made of certain Sectional and general excursions, and members desirous of attending these excursions were asked to hand in their names. The Timetable for the day was indicated as follows:—The Sectional committees would meet at 12 o'clock to arrange sectional timetables, and times of presidential addresses and of the Joint discussions. It was agreed that each committee would consist of the President, Vice President, and Secretary of the Section with one or two other co-opted members. Sectional meetings would start at 2.30 p.m. that day. In the evening a Public

Meeting would be held in the Physics Lecture Room at 8 p.m. at which the Mayor of Dunedin would accord a Civic Reception to members of Congress, the Hector Medal would be presented to Mr. Aston, and Dr. Marshall would give his Presidential Address.

PUBLIC MEETING.

(Minutes of the Sectional Meetings are given below.)

The official welcome to members of the New Zealand Institute and of the Science Congress meeting under its auspices took place in the Physics Lecture room at Otago University on Thursday, 28th January, 1926, at 8 p.m. Dr. P. Marshall, retiring President of the Institute, presided, and there was a large attendance. The Mayor (Mr. H. L. Tapley, M.P.) expressed his genuine pleasure on behalf of the citizens in extending a welcome to the visitors who had come to attend this scientific congress. He was glad to know that they had with them scientists, not only from many parts of New Zealand, but also from Australia. He felt like an atom—(A voice: The mighty atom)—(Laughter)—coming among the galaxy of wisdom and learning. We must all realise the value of the work of men of science to-day, and it behoved all in positions of authority to do what they could to see that funds were available for scientific research. It was to such as those present that they must look for scientific discoveries that would mean much for the future of the world. He hoped that opportunity would be afforded them to visit places of beauty and interest about the city. He gave them all a warm and cordial welcome and trusted that their meetings would prove most successful.—(Applause.) Dr. P. Marshall returned thanks for the welcome accorded to them in this beautiful city. It was a special pleasure to him to return to this city where he had spent sixteen brief and most happy years. It was a special pleasure to them to see the noble pile of buildings that had been erected so that studies might be pushed as far as possible with the means at our disposal. It was a fact well-known throughout New Zealand that Dunedin had taken a greater pride in learning and had done more to promote learning than practically any other city in this country, and that was a record of which the city should be justly proud. His Worship's welcome assured them that the Institute would receive a hearty welcome from all interested in science here. It was a great thing to know that even though they might be recluses in some sense, yet the citizens were represented there in the person of the Mayor to welcome them and to show friendly interest in their activities. He read a number of apologies, including one from His Excellency the Governor-General, and one from the Minister of Internal Affairs.

The Hector Medal.

Dr. Marshall then presented the Hector Medal to Mr. B. C. Aston, who has just been elected President of the Institute. He recalled the manner in which the Hector Medal had been instituted. Sir James Hector was the pioneer adviser and organiser in many branches of science in New Zealand and in his memory a sum had been subscribed

to provide an award in rotation for valuable work in the sciences in which Sir James was interested. On this occasion it was presented for work in chemistry. Mr. Aston had devoted himself with success to the elucidation of the peculiarly baffling problem of bush sickness which affected fully a million acres of pumice land in the North Island. The speaker also referred to the recipient's valuable work in field chemistry. Mr. Aston said he regarded the medal as the highest honour a chemist could receive in New Zealand and acknowledged the great amount of assistance and stimulus he had received from Professor Easterfield. In investigating bush sickness he owed a great deal to his laboratory assistants for loyal support. He would like to have cut the medal up and given them each a piece. (Applause.)

The Presidential Address.

Dr. Marshall's Presidential Address, entitled "Research in New Zealand," appears at the opening of this volume.

PUBLIC MEETING.

Address by Dr. C. C. Farr.

The public meeting of the Science Congress on Saturday, January 30th at 8 p.m. was addressed by Dr. C. Coleridge Farr on "The Story of the Universe." Dr. P. Marshall presided, and, in introducing the lecturer, invited him to clear away from the minds of the audience all remaining doubts on the subject. The lecturer, to begin with, referred to the suns, stars, and planets to be seen in the heavens, and proceeded to discuss different types of nebulae with the aid of some beautifully clear lantern slides. Double stars and star clusters were illustrated and described. It had been estimated that of the stars we saw a third or more were double stars and there were many triple and multiple stars. Probably next in order came the spiral nebulae, none of which could be seen by the naked eye, but of which the most powerful telescope could distinguish half a million. La Place's nebular hypothesis was outlined and criticised. Its central truth lay in the emphasis it placed on the nebulae. It was now concluded that the primitive form of the universe was a gaseous nebula. The history of the development of a nebulae was outlined and some idea given of the vast size and speed of these bodies. Our galactic universe was only one of about half a million similar universes. Dealing next with the solar system, the professor described the forces at work in its making, devoting special attention to theories of the birth of the moon. One of the earliest attempts to estimate the age of the earth was that of Lord Kelvin in 1862, who estimated that the sun had illuminated the earth for some 25,000,000 years. Geologists, basing calculations on the salinity of the ocean, estimated that 180,000,000 years was required, but calculations based on the age of sedimentary rocks, pointed to a period of 350,000,000 years. Radio activity gave a basis for more accurate calculations, and these gave the result of 800,000,000 years. In conclusion, the lecturer briefly summarised the account he had given, showing that it gave to mankind cause for great pride, but also for deep humility. The thanks of the audience were expressed to the lecturer by Mr. H. Brasch.

PUBLIC MEETING.

Address by Dr. P. H. Buck (Te Rangi Hiroa).

On Saturday, 30th January, at 8 p.m. the public lecture in connection with the meeting of the Science Congress was delivered in the physics lecture room by Dr. Peter H. Buck, who is perhaps well known here by his Maori name of Te Rangi Hiroa. The distinction of the lecturer and the interest of his subject—"The Coming of the Maori" —proved a dual attraction that brought together a large audience. Dr. P. Marshall presided, and said they were proud of the fact that Dr. Buck was an old student of Otago University. He referred to Dr. Buck's peculiar qualifications for Polynesian investigations, and said he was widely known as one of the most picturesque lecturers this country possesses. Dr. Buck began by referring to the aspirations that were his as he crossed the Leith Bridge, 27 years ago, a boy fresh from Te Aute College, entering the pakeha's house of learning. Of one thing he had been proud, and that was the Maori blood he derived from his mother.—(Applause.) If he could do anything by lectures or other means to promote good understanding between the two races his sojourn at Otago University would not have been wasted. He briefly reviewed what is known of the origin of mankind in Europe, some 250,000 years ago, and remarked metaphorically the men of the Stone age were represented at the present Science Congress in its geologists.—(Laughter.) He mentioned the three types of European stock, and showed how these had mingled to form the "pure-blooded" English stock.—(Laughter.) Most of the peoples in the early history of the world in migrating walked to their destinations over the land bridges then existing. With the aid of a world map, he showed the vital significance of navigation in the early movements of the Polynesians. Their ancestors were probably a tall, long-headed, dark-skinned race. He had found from the measurement of 424 Maoris that the length of the leg in relation to the length of the body was less in them than in Europeans, and from this he argued that their ancestors had not been a pedestrian people, but had migrated over the water in canoes. The old Maori name for the Pacific was "The Great Ocean of Kiwa," so named after a famous old Maori navigator. He believed that in the early history of these voyagers the Island of Raiatea was of even more importance than the larger island of Tahiti, and Karatea had upon it a marae of great significance, from which they took sacred stones to their new homes. From this centre they made wonderful voyages, including voyages to New Zealand and back, and as far as Easter Island. They came to be absolutely at home on the sea, and to have no fear of it at all. Any fatalities at sea they attributed to some mistake in religious ritual, and it did not inspire them with fear. The early Polynesians made long voyages simply from love of adventure, and some of their undertakings were startling to the point of impudence. The speaker outlined one of the Polynesian traditions describing what one of their voyagers had seen about the year 650 A.D. From this it appeared these men had gone to the "dark sea not seen of the sun" and had reached the Antarctic regions. Others later followed them out of sheer curiosity. He told next of a voyage of Sandwich Islanders to

Tahiti and back again, guided by the stars, and added very interesting details of their methods of navigation and of the "magic calabash" which aided them. Admiral Rodman, of the U.S. Navy, had examined this calabash and found that it gave an angle of 19 degrees. Its purpose was to locate Hawaii, which, as a matter of fact, was on the nineteenth latitude. There was no doubt that a great deal of such knowledge had been lost. The man who got the most votes as having discovered New Zealand was Kupe. He certainly was the man who brought back news and sailing directions. It was quite likely that Maui was the man who fished New Zealand up out of the depths of the unknown, but he never told about it. Kupe lived about the year 950 A.D. He had domestic trouble and thought the best way out of it was a sea voyage.—(Laughter.) He sailed through Cook Strait, which should be Kupe Strait, and he named Somes Island and Ward Island in Wellington Harbour after his two daughters. The last "Hawaiki" from which the Maoris came was not Hawaii, but Tahiti. When Kupe returned he was questioned by the old men. It must be remembered that the ancient traditions of the Maori were definitely taught in schools of learning by "professors" to specially selected students. Dr. Buck told of the store of sacred knowledge that had been committed to writing by an old Maori chief about 1860. His authentic tradition included the sailing directions of Kupe. Kupe did not report seeing any human beings in New Zealand, which he called Aotearoa. Navigators who followed two centuries later found the country inhabited. According to some traditions these early inhabitants were blown away from the west. The lecturer himself thought there must have been people here before 950 A.D. Men were specially selected and trained in self-denial to form the crew of a voyaging canoe. The crews that followed Kupe contained only men. They settled in the Bay of Plenty and mingled with the other dwellers they found here. Two centuries later, again owing to internal dissention in Tahiti, there was another migration of 22 vessels about the year 1350. Every Maori tribe in New Zealand traced its descent to one or other of the voyagers in these canoes. These voyagers brought the taro, the kumara, and other food plants. From the flax they evolved a totally new form of dress. According to tradition the expedition left Tahiti on November 28. It was estimated that the voyage would occupy about a fortnight or three weeks. They saw all the shore ablaze with red of the pohutukawa—the scarlet red of chieftainship welcoming them. By throwing his scarlet badge in the sea the chief symbolically closed the road back home, and they decided to remain in New Zealand. The Maori never offered a prayer for help except to Io, the highest god of all. Their prayer was to placate the evil forces—like the Negro who prayed: "If you can't help me, don't you help that bear."—(Laughter.) In 1492 Columbus made his memorable voyage across the Atlantic, and he had to doctor the log, lest his mutinous sailors should know how far they were from home. There was no fear of that kind about the Maori. He quoted, first in Maori, and then translated, two historic and beautifully poetic and musical songs of the flashing canoe paddle, one of which was a prayer to the god Tane for a safe voyage to Aotearoa. The lec-

turer effectively contrasted the feats of navigation of these Maori and pointed out that they compared not unfavourably with the feats of our English ancestors of which we were so proud. It was essential to instil into the Maori race pride as used to be done in their old houses of learning. Something would have to be done to keep in the Maori some knowledge of their own splendid history. Would it not be useful also to incorporate into the teaching of all young New Zealanders something of the deeds of the Polynesian ancestors of the Maori and of what they accomplished—(loud applause)—so that they in turn would look upon the Maori beside them not as an inferior person, but would have a feeling of equal fellowship, knowing the race from which he had sprung and the deeds of which he was capable? The surest sign of the healing of the breach that had unfortunately occurred between the two races was when, during the war, the Maori people were maintaining a whole battalion of 1,000 in the field—a battalion of well-disciplined troops who had come back to New Zealand carrying the traditions of their ancestors and adding laurels to their records. They came back with this record that, of all dark-skinned races, the Maori of New Zealand held the best record of any in that hardest of all warfare, trench warfare. The Maori looked to the white people to have a right feeling towards them in the difficult days while they were changing from one culture to another. He closed by calling attention to an ancient alarm of his people, which he quoted and translated with dramatic effect. He applied it metaphorically to the present position of the Maori people, watching through fears for the coming of the sun to rise flaming o'er the world. —(Loud Applause.) Dr. Chilton expressed the appreciation of the audience of the lecture they had heard, and said the keen, close interest of the audience had been more eloquent than any words of his. He spoke of our pride in the Maori race, and said we could only think with shame of our part in many contacts we had had with that race. Dr. Buck had reminded us of the duty we owed to the Maori race. We had taken their country and brought them a culture very different from their own. The least we could do was to assist Dr. Buck and encourage that pride of race of which he had spoken. Mr. H. D. Skinner seconded and supported the vote of thanks. Professor H. B. Kirk said he thought that Dr. Buck's appeal should be recognised as not merely one to the emotions, but as one demanding some practical action on their part. He thought that the Science Congress ought to make some recommendation to the Minister of Education on this point. He moved: "That this Congress urges upon the Minister of Education that the teaching of New Zealand history in the schools shall include account of the achievements of the Maori and his Polynesian ancestors, and that we extend the noble traditions of our own race by adding the noble traditions of the Polynesians." The motion was seconded by the Hon. G. M. Thomson, and carried with hearty unanimity.

PUBLIC MEETING.

Address by Mr. A. S. Kenyon.

The concluding meeting of the Congress took place in the Physics Lecture Room on Monday, 1st February, at 8 p.m., when Mr. A. S.

Kenyon, engineer to the Victorian Commission of Waterways and Irrigation, delivered an address on "Problems of Irrigation in Victoria." The Hon. G. M. Thomson presided, and referred to the lecturer as an anthropologist and an authority upon the stone age. Mr. Kenyon, in opening his address, referred to the significance of irrigation in Australia and in Victoria, where already one-fourth of the area was being irrigated. Irrigation schemes of a private nature were started in Victoria in the 'fifties of last century, but came to nothing. The matter was first taken up by the State in 1869, and had been continuously prosecuted ever since. A map was shown of the watershed of the Murray River, which covers a sixth of the whole continent, including the greater part of New South Wales and a considerable area of Queensland. The Murray's flow varied to a maximum 20 times as great as its minimum. One picture thrown on the screen showed the lecturer's assistant standing with the whole river passing between his legs. At other times that river provided 3,000 miles of navigable waterway. They now had 1,750,000 acre-feet in storage, and it was required to irrigate about a million acres. They were now completing a storage dam which would contain about 3,000,000 acre-feet, or two and a-half times as much as is in the Sydney Harbour. Half of this would go to Victoria and half to New South Wales. Other pictures followed of huge dams and irrigation works in different parts of Victoria. Then came detailed pictures showing the actual methods of applying the water to the land. The lecturer described the method of allotting water to the farmers able to profit by it. The amount of loss between the storage dams and the land on which it was used was as yet only a little less than 50 per cent. Methods of excavation were next illustrated and described, and many interesting engineering details given about the construction of weirs and dams. Water was not supplied to any district unless a considerable majority of the landholders there definitely asked for it. A series of pioneering pictures illustrated the rich and beautiful fruits grown with the aid of irrigation. Many pictures were shown of luxuriant lucerne, sugar beet, and orchards. They solved the labour problem, which was always very troublesome there, by making the holdings just of the size that could be managed by one industrious man. Pictures of different processes of handling drying raisins proved of considerabe interest. Most of the dried fruits are exported, the lecturer mentioned, under the Australian Dried Fruit Board. The next slides illustrated the canning industry. The latter portion of the lecture dealt with large systems for supplying water purely for domestic and stock purposes. A map was shown of a district which, valueless and abandoned before the coming of water, had now a capital value of over £50,000,000. In conclusion, recent great developments in wheat growing were described. In answer to the chairman, Mr. Kenyon said that the impregnation of the soil with salts was one of the biggest problems of irrigation. It was highly probable that it was on that account that the ancient irrigation systems of Mesopotamia had been abandoned. He stated that certain types of soil required tile drainage, but others did not. That drainage was very costly.

On the motion of Mr. Morgan, the lecturer was accorded a very hearty vote of thanks.

RECEPTION AT DUNEDIN AND SOUTH SEAS EXHIBITION.

On Saturday, 30th January, about fifty members of Congress and their friends accepted the invitation of the Directors of the Dunedin and South Seas Exhibition to afternoon tea. The chairman of the Exhibition directorate, Mr. J. Sutherland Ross, welcomed the members, and referred to the important relationship between Scientific research and modern business and commercial life. Dr. P. Marshall, the retiring President of the N.Z. Institute, returned thanks on behalf of the Congress members. Visiting members then took the opportunity of visiting some of the Exhibition pavilions.

CONGRESS SERVICE.

A good number of members of Congress accepted the invitation of the First Church Minister and officers to be present in a body at the evening service on Sunday, 31st January.

GENERAL EXCURSIONS.

A considerable number of members of the different sections, into which the Congress had been divided, spent the day of Monday, 1st February, in a most enjoyable excursion to Waipori. Others, to the number of about 50, accepted the invitation to visit the Portobello Fish Hatcheries in the Harbour Board's tug, "Dunedin," and there, under the expert guidance of the Hon. G. M. Thomson, they were given a very clear and comprehensive idea of the valuable work being carried on there.

MINUTES OF SECTIONAL MEETINGS.

SECTION 1.—AGRICULTURE.

President, Mr. A. H. Cockayne; Vice-President, Dr. F. Hilgendorf, F.N.Z. Inst.; Hon. Sec., Mr. E. R. Hudson, B.Sc.

Place of Meeting—Upper Oliver Room

The meetings were well attended throughout, an average of about forty members being present at all sessions.

The following papers and addresses were given:—

Presidential Address:	"The Trend of Agriculture in New Zealand during the past 25 years."
Professor Peren:	"Aspects of Higher Agricultural Education in America."
Professor Ridett:	"Aspects of Higher Agricultural Education in Great Britain."
Dr. F. W. Hilgendorf:	"Aspects of Higher Agricultural Education in New Zealand."
Mr. C. L. Gillies:	"Agricultural Teaching in the Secondary School."
Mr. E. R. Hudson:	"Report on the Subject of Agriculture in the 1925 Matriculation Examination."

Mr. E. S. Lange and Mr. G. S. Ridley:	"Agriculture in the Primary School."
Mr. H. M. Lawton:	"Improved Method in Soil Analysis."
Mr. Bruce Levy:	"The Point Method of Pasture Analysis."
Dr. F. W. Hilgendorf:	"The Fundamentals of Field Experiments."
Mr. M. J. Scott:	"Field Experiments."
Mr. A. W. Hudson:	"Practical Methods in Field Experimental Work."
Mr. T. Rigg:	"The Fineness of Grinding of Limestone."
Professor Watt:	"Some Australian Contributions to Agricultural Progress."

A joint meeting with the Chemistry and Geology Sections was held in order to discuss the question of *Soil Surveys*. At this meeting the following papers were read:—

Mr. T. Rigg:	"Soil Surveys in the Nelson Province."
Mr. H. T. Farrar:	"The most useful basis for a Soil Survey of New Zealand." (Printed in this Volume.)

Mr. Rigg illustrated his lecture by means of soil survey maps of Nelson province and lantern slides.

An interesting paper by Mr. H. T. Farrar, of the Agricultural Department, was also read, and an animated discussion followed. Some of the speakers expressed doubts as to the value of soil surveys and soil analyses, and contended that experimental work was the best way of deciding what the soil was best fitted for and how best to treat it.

Professor Easterfield (director of Cawthron Institute) maintained, however, the great value of soil survey and soil analysis work. The assistance Mr. Rigg had been able to give to farmers and others as the result of that work fully justified it, he stated; it had the effect of checking land speculation.

One of the most interesting meetings of the Science Congress from the public point of view was a combined one of the biology and agricultural sections to discuss the problem of blackberry control. Dr. R. J. Tillyard presided, and the discussion was opened by Mr. A. H. Cockayne. Mr. Cockayne disclaimed any great knowledge of the subject. Popularly, he said, for some reason he did not quite understand, the blackberry was considered to be the most serious weed menace in the Dominion. It was not clear why the blackberry should be so viewed when the matter was considered in proper perspective. The blackberry was not causing a great diminution of the production; not nearly as much, for instance, as the common bracken. The reason why is was so seriously viewed was the danger that it might become dominant over intensely cultivated land. He believed he was correct in saying that the blackberry had not overrun any land capable of carrying two sheep to the acre in winter. With many weeds, proper management of stocking tended to reduce their spread. This would also hold good of blackberry if it were not for the fact that blackberry tended to reduce the stock on the land. Frequently areas that were only comparatively badly infested were sparsely stocked because of the trouble blackberry caused with sheep, for instance. In the majority of instances, the cleaning up of blackberry was confined to those areas that could be ploughed. There was no reason why blackberry land that was ploughable should not be made good grass land by good farm management. The majority of the unploughable land now occupied by blackberry did not come under the heading of first-class land. There was, however, an exception in the area from Napier to Wairoa, where until lately the farmers had done nothing to prevent the spread of blackberry or to comply with the provisions of the Noxious Weeds Act. Recently the farmers there had come to the conclusion that they were

being seriously menaced and had applied to the Government to free them from the menace without cost to themselves. At present there was a good deal being done in cutting and spraying, and by the use of goats to control the pest. Blackberry had distinct ecological relationships as far as distribution was concerned, and he would like to see this carefully studied. There were large areas in New Zealand in which it would be impossible for the blackberry to spread, but, on the other hand, there were large areas where it could become a menace. A bonus of £10,000 had been offered for a method of eradicating the blackberry. He himself had drawn up the conditions and could say that any man who complied with them would have earned the £10,000. The basis was that the method must not be more expensive than the cost of twice cutting down the blackberry. They had a graduate of Otago University specifically engaged on the study of the blackberry and its relation to soil, climate, and other conditions. The present position as far as spraying was concerned was not so satisfactory, save that the sprays that were most toxic were expensive. They usually included arsenic, and that was a danger to stock where the area was not safely fenced off. The method that probably was giving the best results at the present time was the use of goats.

In the use of goats there was a certain amount of what he might call farm ritual to be observed. The main objection to goats was they were the greatest jumpers in the world, and the fencing necessary to keep them in would bankrupt any wool king. Dr. Tillyard said he would deal with the question simply from the point of view of control by natural enemies. His information was that the menace was serious, and was increasing, and he knew of a number who had thrown up their farms on account of blackberry. Till recently there was only one case of the control of a weed by its natural enemies. This was the case of the lantasia in Hawaii where the actual seeding of the plant had been stopped by the introduction of insects. In Australia there was a wonderful illustration of what could be done with the prickly pear, which now covered an area as large as Tasmania, and was said to be increasing by a million acres a year. A company had been floated with a large capital for clearing land by means of a heavy gas, but the company had never paid. Many other methods had been suggested, until the only thing left was to attempt to control it by the natural enemy. The insects already liberated were now doing magnificent work, and, in the opinion of the officers concerned, it was only a matter of time when the whole of the pest would be cleared out by these insects. As a biologist he held that the position here was serious enough to warrant the attempt to control the blackberry by insects. If the authorities in Australia had been guided by the opinions of leading biologists and entomologists they would never have taken the risk of introducing the insects. They felt that the position was so desperate that a desperate remedy must be tried. A group of thirty insects was gathered from North and South America, and these were all carefully tested on as many as seventy different economic plants as well as on prickly pear, before they were liberated. Only those were liberated that attacked nothing else than the prickly pear. He thought himself that the chances of control of blackberry in this way were about 50—50, but he did not want that to remain an opinion, but to have it thoroughly tested. His first proposition was that no insect except one that fed only on the genus *Rubus* should be allowed to enter New Zealand. He was against taking any risk for other plants. He thought the starvation test should be applied to the insects under observation at different stages of their development, both in the country of their origin and in New Zealand. He was not asking permits to liberate insects, but to bring them in under strict quarantine conditions. It was essential that they should have large insectaria with room to grow quantities of blackberry under natural conditions. Every part of the blackberry from the root up was attacked in some part of the world or other by insects. There were two insects which offered tremendous possibilities, by attacking the tips of the shoots and the fruiting head. There would be grave danger of it attacking raspberry. There was another insect found in Belguim which did grave damage to the stems. There were a great number of leaf feeders that might combine with the other insects he had mentioned in attacking the blackberry. He was to fight

the idea that in no case should insects be introduced to attack a plant. Each case should be considered on its own merits. Mr. Cockayne suggested that experiments might be conducted in the Chatham Islands without any risk to New Zealand. He was a little bit sceptical about the prickly pear position in Queensland. If any great progress had been made it had been very lately.

Dr. Tillyard, referring to Queensland, said that only one insect had been liberated for three years, and they had in the cages insects that promised even better results.

He had been at pains to get at the latest information from Queensland.

Professor Easterfield said that a very important New Zealand industry, the Flax industry, seemed to him to be threatened by the blackberry.

Mr. Cockayne said the blackberry was a serious menace in some of the flax swamps but not in others.

One speaker pointed out that the blackberry was related to a number of economic plants, and also that the great varieties of climate complicated the problem.

Professor R. D. Watt (Sydney) said it was too early yet to say that one insect would wipe out the prickly pear. There was a case in Australia of a species of plant being entirely wiped out by an insect. He was very hopeful. however, that they would in time get logical control of the prickly pear.

Mr. Cockayne referred to an interesting case of eradication of blackberry about Port Underwood by rose scale. The rose scale was effective there doubtless owing to the absence of the parasites which made it useless elsewhere.

On the last afternoon an excursion was made to the Taieri Plain, and the Waironga Clydesdale Stud Farm was visited. Members much appreciated the country, and hospitality extended by Messrs. Thomson Bros. of Waironga on this occasion.

SECTION 2.—BIOLOGY.

President, Dr. R. J. Tillyard, F.R.S., M.A., F.N.Z. Inst.; Vice President, Mr. R. M. Laing, M.A., B.Sc., F.N.Z. Inst.; Hon. Sec., Mr. W. Martin, B.Sc.

Place of Meeting—Physiology Room.

There was an average attendance of about twenty members. The following papers and addresses were given:—

Presidential Address:	"The progress of Economic Entomology in Australia and New Zealand."
Dr. H. H. Allan:	"The F_1 Generation of *Coprosma prop-* × *C. robusta.*"
Hon. G. M. Thomson:	"The Pollination of New Zealand Flowers by Birds and Insects." (Printed in this Volume.)
Hon. G. M. Thomson:	"The Occurrence of Pilchards and Sprats in New Zealand Seas." (Printed in this Volume.)
Mr. D. Millar:	"Calcium cyanide as an Insecticide."
Mr. D. Millar:	"The Influence of Insects on the Forests and Timber of New Zealand."
Mr. M. Young:	"The Marine Biology of the Chatham Islands."
Mr. R. M. Laing:	"The External Distribution and Relationships of the New Zealand Marine Algae." (Printed in this Volume.)

Mr. W. Martin:	"The Botany of the Chatham Islands."
Mr. R. Gourlay:	"Notes on a New Zealand Wood-Wasp." (Printed in this Volume.)
Dr. K. N. Curtis:	"The Susceptibility of Prunus Species of *Sclerotina cinerea*: Modern Theories and additional data."
Miss B. J. Murray:	"Four Fungi on Endemic Species of Rubus in New Zealand." (Printed in this Volume.)
Mr. W. Martin:	"Additional Knowledge in respect to the flora of the Dunedin District."
Mr. A. L. Tonnoir:	"Muscidae Acalyptratae of New Zealand."
Mr. A. L. Tonnoir:	"Fungus Gnats of New Zealand." (Printed in this Volume.)

The following resolutions were carried and were afterwards submitted to the Joint Meeting of Sectional Committees, held at the end of the Congress:—

1. That a section of Forestry be included in the next Science Congress.—Carried by 8 to 5.
2. That at the next Science Congress a Symposium be arranged for, in which should be discussed, from the points of view of workers in various departments of Science, the question of New Zealand's last land connections.—Carried *nem. con.*

The botanical members made an all day visit to the peat bogs on Maungatua. A combined meeting was held with the Agriculture Section on the subject of Blackberry Control. (See above.)

SECTION 3.—GEOLOGY.

President, Mr. J. A. Bartrum, M.Sc.; Vice President, Dr. J. A. Thomson, M.A., F.G.S., F.N.Z. Inst.; Hon. Sec., Dr. W. N. Benson, F.G.S.

Place of Meeting—Geology Lecture Room.

The following Addresses and papers were given:—

Presidential Address:	"Geological Education in New Zealand to the Community."
Mr. P. G. Morgan:	"Wave cut platforms near Titahi Bay and Porirua South Head and their significance."
Mr. R. A. Waghorn:	"The Geology of the Ruakokopatuna Valley, South Wairarapa." (Printed in this Volume.)
Mr. C. R. Laws:	"The Geology of the Papakura-Hunua District."
Mr. H. J. Finlay:	"Notes on the Turridae."
Professor Speight:	"The Geology of the Malvern Hills."
Dr. J. A. Thomson:	"Marine horizons in the Tertiary of Brachiopod evidence of their Age."
Dr. J. A. Thomson:	"Marine Phosphatic horizons in the Tertiary Beds of Otago and South Canterbury." (Printed in New Zealand Journal of Science and Technology.)

Professor T. G. Taylor (Sydney):	"Notes on the Glaciation of Ruapehu." (Printed in this Volume.)
Dr. J. Marwick:	"The Indo-Pacific Affinities of the New Zealand Tertiary Mollusca."
Professor J. Park:	"An Outline of the Geology of New Zealand."
Professor J. Park:	"The Great Moraine at Lake Rotorua."
Professor J. Park:	"On the Occurrence of Belemnites at Shag Point."
Dr. P. Marshall:	"The Geology of Mangaia."
Mr. C. L. Carter and Dr. W. N. Benson:	"Iodine in New Zealand Soils and Waters, and its Geological Significance."
Mr. W. Penseler:	"The Mode of Occurrence and Microscopic Structure of the Coal in the James River."
Professor Speight:	"The Varve Glacial Silts of Rakaia Gorge."
Mr. J. A. Bartrum:	"The Topographic Features of the Western side of the Hauraki Gulf." (Printed in this Volume.)
Dr. W. N. Benson:	"The Geology of the Leith and Kaikorai Valleys."

A combined meeting of the Geology, Agriculture and Chemical Sections was held to discuss the Methods and Problems of Soil Survey (see above).

An excursion took place to Nicholl's Creek, where Professor Benson demonstrated some of the evidence upon which he based the conclusions given in his paper.

The following resolutions were carried and sent forward to the Joint meeting of Sectional Committees for consideration:—

1. That Geology should be recognised by the New Zealand University as a subject for the Matriculation Examination.
2. That at the next Science Congress a Symposium should be arranged for on the subject of the former land connections with New Zealand.

SECTION 4.—CHEMISTRY, PHYSICS AND ENGINEERING.

President, Dr. C. C. Farr, F.N.Z. Inst.; Vice President, Dr. E. Marsden, F.N.Z. Inst.; Hon. Sec., Mr. C. L. Carter, M.Sc.

Place of Meeting—Physics Lecture Room.

The attendance of members varied from eight to twenty. The following addresses and papers were given:—

Presidential Address:	"The Relation of Science to Industry."
Mr. H. P. Thomas:	"Electrical Supply Methods."
Mr. R. R. Nimmo:	"Some properties of Neon Lamps."
Prof. G. H. Denham and Mr. J. Parker:	"An improved Hydrogen Sulphide Apparatus." (Printed in this Volume.)

Prof. G. H. Denham:	"A Problem in Boiler Corrosion." (Printed in this Volume.)
Prof. J. K. H. Inglis:	"Essential oils in some New Zealand Plants."
Mr. R. Y. Penseler:	"Natural Resins."
Mr. M. N. Rogers:	"The Radon and Iodine content of some New Zealand waters." (Printed in this Volume.)
General Discussion:	"The Relation of Science and Industry."

A Joint meeting was held with the Agriculture and Geology Section on the question of the Basis for a Soil Survey in New Zealand.

Section 5.—Anthropology.

President, Dr. P. H. Buck, F.N.Z. Inst.; Vice Presidents, The Hon. A. T. Ngata, M.A., LL.B., M.P., and Mr. A. S. Kenyon; Hon. Sec., Mr. H. D. Skinner, B.A. (N.Z. and Cantab.).

Place of Meeting—General Biology Lecture Room (The Museum).

By mutual arrangement this section held a number of its meetings in conjunction with Section 6.

The attendance of members ranged from five to twenty-five.

The following addresses and papers were given:—

Presidential Address:	"The Value of Tradition in Polynesian Research."
Mr. A. S. Kenyon:	"A day on an Australian Stone-Age Site."
Dr. Buck:	"The Carving of Toki Pou-tangata."
Mr. H. Hamilton:	"Kaingaroa Rock Carvings."
Dr. E. S. Handy:	"The Polynesian Oracle House." (Printed in Polynesian Journal, 1926.)
Mr. H. D. Skinner:	"South Canterbury Rock Paintings."
Discussion on:	"The Physical Anthropology of the Tuhoe Tribe."
Mr. A. S. Kenyon:	"Classification of Australian Stone Implements."
Mr. F. V. Knapp:	"Classification of Stone Adges and Chisels from Tasman Bay."

Two Museum demonstrations took place. Two separate all day Excursions were held at Long Beach and Murdering Beach, and at Pipikariti respectively.

Section 6.—Social Science and Economics.

President, Professor J. Shelley, M.A.; Vice Presidents, Dr. H. G. Scholefield, O.B.E., D.Sc. (Lond.); F. R. Hist, S.; Hon. Sec., Mr. J. Johnson, M.A.

Place of Meeting—Lower Oliver Room

By mutual arrangement this Section held several of its meetings in conjunction with Section 5.

The following addresses and papers were given:—

Presidential Address:	"Rapid Communication and Social Revolution."
Dr. G. H. Scholefield:	"The Racial Composition of the New Zealand people."
Mr. W. J. Bowman:	"Rural Co-operation Credit in New Zealand."
Mr A. Munro:	"The Future of Craftsmanship."
Dr. E. P. Neale:	"Demographic Characteristics of Newly Settled Lands."
Prof. A. G. B. Fisher:	"The Significance of Over-importation."

A general discussion took place on the work of the Section. It was strongly urged that at future Science Congresses arrangements should be made for more Joint Sectional Discussions on topics of general interest, and that long papers of specialized interest should be given a less important place in the Congress.

RESOLUTIONS OF CONGRESS.

At the conclusion of the Congress a Joint meeting of the Sectional Committees took place, and the resolutions passed by the various Sections were considered.

1. The remit from the Biology Section that in future Congresses there be a Section for Forestry.—*Not agreed to.*
2. The remit from the Geology Section that the Board of Governors of the New Zealand Institute be asked to request the University Senate to consider the desirability of recognising Geology as one of the optional subjects for the Matriculation Examination.—*Agreed to.*
3. The remit from the Biology and Geology that at the next Congress the Board of Governors be asked to arrange for the holding of a Symposium on the subject of former land connections with New Zealand, and that a precis of all the salient points of this Symposium be published for the information of students.

The following two resolutions were passed by the Joint meeting of Sectional Committees.

1. That at future Congresses a large proportion of the time of the Congress be allocated to the discussion of questions of general interest, and that the Standing Committee be asked to avoid clashing with the hours of meeting of the Annual Meeting of the Board of Governors.

The following resolution was passed at the Public Meeting of Congress on the evening of Saturday, January 30:—

That this Congress urges upon the Minister of Education that the teaching of New Zealand history in the schools shall include accounts of the achievements of the Maori and his Polynesian ancestor, and that we extend the noble traditions of our own race by adding the noble traditions of the Polynesians.

Proposed by Professor H. B. Kirk, seconded by Hon. G. M. Thomson, and carried unanimously.

APPENDIX.

NEW ZEALAND INSTITUTE ACT, 1908.
1908, No. 130.

AN ACT to consolidate certain Enactments of the General Assembly relating to the New Zealand Institute.

BE IT ENACTED by the General Assembly of New Zealand in Parliament assembled, and by the authority of the same, as follows:—

1. (1.) The Short Title of this Act is the New Zealand Institute Act, 1908.

(2.) This Act is a consolidation of the enactments mentioned in the Schedule hereto, and with respect to those enactments the following provisions shall apply: —

(*a*) The Institute and Board respectively constituted under those enactments, and subsisting on the coming into operation of this Act, shall be deemed to be the same Institute and Board respectively constituted under this Act without any change of constitution or corporate entity or otherwise; and the members thereof in office on the coming into operation of this Act shall continue in office until their successors under this Act come into office.

(*b*) All Orders in Council, regulations, appointments, societies incorporated with the Institute, and generally all acts of authority which originated under the said enactments or any enactment thereby repealed, and are subsisting or in force on the coming into operation of this Act, shall enure for the purposes of this Act as fully and effectually as if they had originated under the corresponding provisions of this Act, and accordingly shall, where necessary, be deemed to have so originated.

(*c*) All property vested in the Board constituted as aforesaid shall be deemed to be vested in the Board established and recognised by this Act.

(*d*.) All matters and proceedings commenced under the said enactments, and pending or in progress on the coming into operation of this Act, may be continued, completed, and enforced under this Act.

2. (1.) The body now known as the New Zealand Institute (hereinafter referred to as "the Institute") shall consist of the Auckland Institute, the Wellington Philosophical Society, the Philosophical Institute of Canterbury, the Otago Institute, the Hawke's Bay Philosophical Institute, the Nelson Institute, the Westland Institute, the Southland Institute, and such others as heretofore have been or may hereafter be incorporated therewith in accordance with regulations heretofore made or hereafter to be made by the Board of Governors.

(2.) Members of the above-named incorporated societies shall be *ipso facto* members of the Institute.

3. The control and management of the Institute shall be vested in a Board of Governors (hereinafter referred to as "the Board"), constituted as follows:—

The Governor:

The Minister of Internal Affairs:

Four members to be appointed by the Governor in Council, of whom two shall be appointed during the month of December in every year.

Two members to be appointed by each of the incorporated societies at Auckland, Wellington, Christchurch, and Dunedin during the month of December in each alternate year; and the next year in which such an appointment shall be be made is the year one thousand nine hundred and nine.

One member to be appointed by each of the other incorporated societies during the month of December in each alternate year; and the next year in which such an appointment shall be made is the year one thousand nine hundred and nine.

4. (1.) Of the members appointed by the Governor in Council, the two members longest in office without reappointment shall retire annually on the appointment of their successors.

(2.) Subject to the last preceding subsection, the appointed members of the Board shall hold office until the appointment of their successors.

5. The Board shall be a body corporate by the name of the "New Zealand Institute," and by that name shall have perpetual succession and a common seal, and may sue and be sued, and shall have power and authority to take, purchase, and hold lands for the purposes hereinafter mentioned.

6. (1.) The Board shall have power to appoint a fit person, to be known as the "President," to superintend and carry out all necessary work in connection with the affairs of the Institute, and to provide him with such further assistance as may be required.

(2.) The Board shall also appoint the President or some other fit person to be editor of the Transactions of the Institute, and may appoint a committee to assist him in the work of editing the same.

(3. The Board shall have power from time to time to make regulations under which societies may become incorporated with the Institute, and to declare that any incorporated society shall cease to be incorporated if such regulations are not complied with; and such regulations on being published in the *Gazette* shall have the force of law.

(4.) The Board may receive any grants, bequests, or gifts of books or specimens of any kind whatsoever for the use of the Institute, and dispose of them as it thinks fit.

(5.) The Board shall have control of the property from time to time vested in it or acquired by it; and shall make regulations for the management of the same, and for the encouragement of research by the members of the Institute; and in all matters, specified or unspecified shall have power to act for and on behalf of the Institute.

7. (1.) Any casual vacancy in the Board, howsoever caused, shall be filled within three months by the society or authority that ap-

pointed the member whose place has become vacant, and if not filled within that time the vacancy shall be filled by the Board.

(2.) Any person appointed to fill a casual vacancy shall only hold office for such period as his predecessor would have held office under this Act.

8. (1.) Annual meetings of the Board shall be held in the month of January in each year, the date and place of such annual meeting to be fixed at the previous annual meeting.

(2.) The Board may meet during the year at such other times and places as it deems necessary.

(3.) At each annual meeting the President shall present to the meeting a report of the work of the Institute for the year preceding, and a balance-sheet, duly audited, of all sums received and paid on behalf of the Institute.

9. The Board may from time to time, as it sees fit, make arrangements for the holding of general meetings of members of the Institute, at times and places to be arranged, for the reading of scientific papers, the delivery of lectures, and for the general promotion of science in New Zealand by any means that may appear desirable.

10. The Minister of Finance shall from time to time, without further appropriation than this Act, pay to the Board the sum of five hundred pounds in each financial year, to be applied in or towards payment of the general current expenses of the Institute.

11. Forthwith upon the making of any regulations or the publication of any Transactions, the Board shall transmit a copy thereof to the Minister of Internal Affairs, who shall lay the same before Parliament if sitting, or if not, then within twenty days after the commencement of the next ensuing session thereof.

SCHEDULE.

Enactments consolidated.

1903, No. 48. The New Zealand Institute Act, 1903.

NEW ZEALAND INSTITUTE AMENDMENT ACT, 1920.

1920, No. 3.

AN ACT to amend the New Zealand Institute Act, 1908.

[*30th July, 1920.*

BE IT ENACTED by the General Assembly of New Zealand in Parliament assembled, and by the authority of the same, as follows:—

1. This Act may be cited as the New Zealand Institute Amendment Act, 1920, and shall be read together with and deemed part of the New Zealand Institute Act, 1908.

2. Section ten of the New Zealand Institute Act, 1908, is hereby amended by omitting the words "five hundred pounds," and substituting the words " one thousand pounds."

FROM THE FINANCE ACT, 1925, No. 51.

7. (1.) The Minister of Finance shall, without further authority than this section, pay to the Board of Governors of the New Zealand

Institute the sum of one thousand five hundred pounds in each financial year, commencing with the year beginning on the first day of April, nineteen hundred and twenty-five, to be applied in or towards payment of the general expenses of the Institute.

(2.) This section is in substitution for section ten of the New Zealand Institute Act, 1908, and that section and the New Zealand Institute Amendment Act, 1920, are hereby repealed.

REGULATIONS.

THE following are the regulations of the New Zealand Institute under the Act of 1903:—*

The word "Institute" used in the following regulations means the New Zealand Institute as constituted by the New Zealand Institute Act, 1903.

INCORPORATION OF SOCIETIES.

1. No society shall be incorporated with the Institute under the provisions of the New Zealand Institute Act, 1903, unless such society shall consist of not less than twenty-five members, subscribing in the aggregate a sum of not less than £25 sterling annually for the promotion of art, science, or such other branch of knowledge for which it is associated, to be from time to time certified to the satisfaction of the Board of Governors of the Institute by the President for the time being of the society.

2. Any society incorporated as aforesaid shall cease to be incorporated with the Institute in case the number of the members of the said society shall at any time become less than twenty-five, or the amount of money annually subscribed by such members shall at any time be less than £25.

3. The by-laws of every society to be incorporated as aforesaid shall provide for the expenditure of not less than one-third of the annual revenue in or towards the formation or support of some local public museum or library, or otherwise shall provide for the contribution of not less than one-sixth of its said revenue towards the extension and maintenance of the New Zealand Institute.

4. Any society incorporated as aforesaid which shall in any one year fail to expend the proportion of revenue specified in Regulation No. 3 aforesaid in manner provided shall from henceforth cease to be incorporated with the Institute.

PUBLICATIONS.

5. All papers read before any society for the time being incorporated with the Institute shall be deemed to be communications to the Institute, and then may be published as Proceedings or Transactions of the Institute, subject to the following regulations of the Board of the Institute regarding publications:—

(*a.*) The publications of the Institute shall consist of—

(1.) A current abstract of the proceedings of the societies for the time being incorporated with the Institute, to be intituled "Proceedings of the New Zealand Institute";

*New Zealand Gazette, 14th July, 1904.

(2.) And of transactions comprising papers read before the incorporated societies (subject, however, to selection as hereinafter mentioned), and of such other matter as the Board of Governors shall from time to time determine to publish, to be intituled "Transactions of the New Zealand Institute."

(*b.*) The Board of Governors shall determine what papers are to be published.

(*c.*) Papers not recommended for publication may be returned to their authors if so desired.

(*d.*) All papers sent in for publication must be legibly written, typewritten, or printed.

(*e.*) A proportional contribution may be required from each society towards the cost of publishing Proceedings and Transactions of the Institute.

(*f.*) Each incorporated society will be entitled to receive a proporportional number of copies of the Transactions and Proceedings of the New Zealand Institute, to be from time to time fixed by the Board of Governors.

Management of the Property of the Institute.

6. All property accumulated by or with funds derived from incorporated societies, and placed in charge of the Institute, shall be vested in the Institute, and be used and applied at the discretion of the Board of Governors for public advantage, in like manner with any other of the property of the Institute.

7. All donations by societies, public Departments, or private individuals to the Institute shall be acknowledged by a printed form of receipt and shall be entered in the books of the Institute provided for that purpose, and shall then be dealt with as the Board of Governors may direct.

Honorary Members.

8. The Board of Governors shall have power to elect honorary members (being persons not residing in the Colony of New Zealand), provided that the total number of honorary members shall not exceed thirty.

9. In case of a vacancy in the list of honorary members, each incorporated society, after intimation from the Secretary of the Institute, may nominate for election as honorary member one person.

10. The names, descriptions, and addresses of persons so nominated, together with the grounds on which their election as honorary members is recommended, shall be forthwith forwarded to the President of the New Zealand Institute, and shall by him be submitted to the Governors at the next succeeding meeting.

Additional Regulation adopted by Board of Governors on 30th January, 1923, and published in the New Zealand Gazette *of 28th May, 1925.*

10A. Vacancies in the list of honorary members shall be announced at each annual meeting of the Board of Governors, and such announcement be communicated as early as possible to each incorporated

society, and each such society shall on or before the 1st December nominate one person for each vacancy as honorary member, and the election shall take place at the next annual meeting of the Board of Governors.

General Regulations.

11. Subject to the New Zealand Institute Act, 1908, and to the foregoing rules, all societies incorporated with the Institute shall be entitled to retain or alter their own form of constitution and the by-laws for their own management, and shall conduct their own affairs.

12. Upon application signed by the President and countersigned by the Secretary of any Society, accompanied by the certificate required under Regulation No. 1, a certificate of incorporation will be granted under the seal of the Institute, and will remain in force as long as the foregoing regulations of the Institute are complied with by the society.

13. In voting on any subject the President is to have a deliberate as well as a casting vote.

14. The President may at any time call a meeting of the Board, and shall do so on the requisition in writing of four Governors.

15. Twenty-one days' notice of every meeting of the Board shall be given by posting the same to each Governor at an address furnished by him to the Secretary.

16. In case of a vacancy in the office of President, a meeting of the Board shall be called by the Secretary within twenty-one days to elect a new President.

17. The Governors for the time being resident or present in Wellington shall be a Standing Committee for the purpose of transacting urgent business and assisting the officers.

18. The Standing Committee may appoint persons to perform the duties of any other office which may become vacant. Any such appointment shall hold good until the next meeting of the Board, when the vacancy shall be filled.

19. The foregoing regulations may be altered or amended at any annual meeting, provided that notice be given in writing to the Secretary of the Institute not later than 30th November.

The following additional regulations, and amendment to regulations, were adopted at a general meeting of the Board of Governors of the New Zealand Institute, held at Wellington on the 30th January, 1918, and at Christchurch on the 3rd February, 1919. (See *New Zealand Gazette*, No. 110, 4th September, 1919.)

Regulations governing the Fellowship of the Institute.

20. The Fellowship of the New Zealand Institute shall be an honorary distinction for the life of the holder.

21. The Original Fellows shall be twenty in number, and shall include the past Presidents and the Hutton and Hector Medallists who have held their distinctions and positions prior to 3rd February, 1919, and who at that date are members of the Institute. The remaining Original Fellows shall be nominated as provided for in Regula-

tion 26 (*a*), and shall be elected by the said past Presidents and Hector and Hutton Medallists.

22. The total number of Fellows at any time shall not be more than forty.

23. After the appointment and election of the Original Fellows, as provided in Regulation 21, not more than four Fellows shall be elected in any one year.

24. The Fellowship shall be given for research or distinction in science.

25. No person shall be elected as Fellow unless he is a British subject and has been a member of one of the incorporated societies for three years immediately preceding his election.

26. After the appointment and election of the Original Fellows as provided in Regulation 21 there shall be held an annual election of Fellows at such time as the Board of Governors shall appoint. Such election shall be determined as follows:—

(*a*.) Each of the incorporated societies at Auckland, Wellington, Christchurch, and Dunedin may nominate not more than twice as many persons as there are vacancies, and each of the other incorporated societies may nominate as many persons as there are vacancies. Each nomination must be accompanied by a statement of the qualifications of the candidate for Fellowship.

(*b*.) Out of the persons so nominated the Fellows resident in New Zealand shall select twice as many persons as there are vacancies, if so many be nominated.

(*c*.) The names of the nominees shall be submitted to the Fellows at least six months, and the names selected by them submitted to the Governors at least three months, before the date fixed for the annual meeting of the Board of Governors at which the election is to take place.

(*d*.) The election shall be made by the Board of Governors at the annual meeting from the persons selected by the Fellows.

(*e*.) The methods of selection in subclause (*b*) and of the election in sub-clause (*d*) shall be determined by the Board of Governors.

(*f*.) The official abbreviation of the title "Fellow of the New Zealand Institute" shall be "F.N.Z.Inst."

Additional Regulation adopted by Board of Governors on 30th January, 1923, and published in the New Zealand Gazette *of 28th May, 1925.*

26A. The consent of the candidate must be obtained in writing.

The information regarding each candidate shall be condensed to one foolscap sheet of typewritten matter.

When a candidate is proposed by more than one society it shall be sufficient to circulate to voters the information supplied by one society.

Subsection (*e*) shall be rescinded, and the following inserted:-

***Method of Selection in Subclause* (b) *and of Election in Subclause* (d)**

Names of Candidates, in Alphabetical Order.	X
APPLE, CHARLES	
BROWN, JOHN	
SMITH, JAMES	

There are vacancies to be filled. Place a cross in the column marked X against the name of each candidate for whom you wish to vote. The vote will be invalid if—

(*a.*) More than the required number is voted for on the paper:

(*b*) The voter signs the voting-paper:

(*c.*) The voting-paper is not returned on the date announced.

AMENDMENT TO REGULATIONS.

Regulation 5 (*a*) of the regulations published in the *New Zealand Gazette* on the 14th July, 1904, is hereby amended to read:—

"(*a.*) The publications of the Institute shall consist of—

" (1.) Such current abstract of the proceedings of the societies for the time being incorporated with the Institute as the Board of Governors deems desirable;

" (2.) And of transactions comprising papers read before the incorporated societies or any general meeting of the New Zealand Institute (subject, however, to selection as hereinafter mentioned), and of such other matter as the Board of Governors shall from time to time for special reasons in each case determine to publish, to be intituled *Transactions of the New Zealand Institute.*"

ADDITIONAL REGULATIONS.

The following additional regulations, made at various times by the Board of Governors under the New Zealand Institute Act, 1908, were adopted at a general meeting of the Board held on the 30th January, 1923, and published in the *New Zealand Gazette* of the 28th May, 1925.

BOARD OF GOVERNORS.

Members of the Board of Governors shall not hold any paid office under the Board.

GENERAL REGULATIONS.

The President shall be *ex officio* a member of all committees.

The Hon. Editor shall be convener of the Publications Committee.

The seal of the old Institute bearing the date of establishment as 1867 shall be adopted as the seal of the New Zealand Institute reconstituted by the New Zealand Institute Act, 1903, and continued by the New Zealand Institute Act, 1908.

An abstract of all business transacted at each meeting of the Standing Committee shall be prepared and communicated to all members of the Board after each meeting.

The quorum of the Standing Committee meetings shall be four.

ENDOWMENT FUND.

A fund to be called an " Endowment Fund " shall be set up, the interest on which for any year may be spent for purposes of the Institute, but the capital may not be spent.

All interest accruing from moneys deposited in the Institute's General Account in the Post Office Savings-bank shall be credited to the Endowment Fund, unless otherwise allocated by the Board at the annual meeting at which the amount of the annual interest is reported.

TRUST ACCOUNTS.

Trust-moneys — namely, the Carter, Hector, Hutton, and Hamilton Funds—shall, when deposited in the Post Office Savings-bank, be placed in separate accounts for each trust.

REGULATIONS FOR ADMINISTERING THE GOVERNMENT RESEARCH GRANT.*

ALL grants shall be subject to the following conditions, and each grantee shall be duly informed of these conditions:—

1. All instruments, specimens, objects, or materials of permanent value, whether purchased or obtained out of or by means of the grant, or supplied from among those at the disposal of the Institute, are to be regarded, unless the Research Grants Committee decide otherwise, as the property of the Institute, and are to be returned by the grantee, for disposal according to the orders of the committee, at the conclusion of his research, or at such other time as the committee may determine.

2. Every one receiving a grant shall furnish to the Research Grants Committee, on or before the 1st January following upon the allotment of the grant, a report (or, if the object of the grant be not attained, an interim report, to be renewed at the same date in each subsequent year until a final report can be furnished or the committee dispense with further reports), containing (*a*) a brief statement showing the results arrived at or the stage which the inquiry has reached; (*b*) a general statement of the expenditure incurred, accompanied, as far as is possible, with vouchers; (*c*) a list of the instruments, specimens, objects, or materials purchased or obtained out of the grant, or supplied by the committee, which are at present in his possession; and (d) reference to any transactions, journals, or other publications in which results of the research have been printed. In the event of the grantee failing to send in within three months of the said 1st January a report satisfactory to the committee he may be required, on resolution of the Board of Governors, to return the whole of the sum allotted to him.

3. Where a grant is made to two or more persons acting as a committee for the purpose of carrying out some research, one member

*In addition to these regulations the Standing Committee is also bound by certain resolutions which appear on page 536 of volume 49, *Trans. N.Z Inst.*, and which grantees are also bound to observe.

of the said committee shall assume the responsibility of furnishing the report and receiving and disbursing the money.

4. Papers in which results are published that have been obtained through aid furnished by the Government grant should contain an acknowledgment of that fact.

5. Every grantee shall, before any of the grant is paid to him, be required to sign an engagement that he is prepared to carry out the general conditions applicable to all grants, as well as any conditions which may be attached to his particular grant.

6. In cases where specimens or preparations of permanent value are obtained through a grant the committee shall, as far as possible, direct that such specimens shall be deposited in a museum or University college within the province where the specimens or material were obtained, or in which the grantee has worked. The acknowledgment of the receipt of the specimens by such institution shall fully satisfy the claims of the Institute.

7. In cases where, after completion of a research, the committee directs that any instrument or apparatus obtained by means of the grant shall be deposited in an institution of higher learning, such deposit shall be subject to an annual report from the institution in question as to the condition of the instrument or apparatus, and as to the use that has been made of it.

Additional Regulations adopted by Board of Governors on 30th January, 1923, and published in the New Zealand Gazette *of 28th May, 1925.*

8. Grants shall be given preferentially to investigations which appear to have an economic bearing; purely scientific investigations to be by no means excluded. When the research is one that leads to a direct economic advance the Government shall reserve to itself the right of patenting the discovery and of rewarding the discoverer. but it is to be understood that grants from the research-grant vote are not in the nature of a reward or a prize. but for out-of-pocket expenses incurred by the research worker, including salary or endowment of assistant, but not salary for the grantee himself. Plants. books, apparatus, chemicals, &c., purchased for applicants are to remain the property of the Institute, and eventually to form a loan collection of apparatus in the manner now practised by the Royal Society of London.

First method of initiating researches: Applications shall be invited for grants in aid of research to be specified by applicants.

Second method of initiating researches: The Governors of the Institute shall suggest from time to time subjects the investigation of which is desirable, and ask capable investigators to undertake such researches, the Institute paying for apparatus, material, and working-expenses, including assistance.

9. All applications for grants shall come through some incorporated society.

10. In the case of a refusal to recommend a grant, the Standing Committee shall not give any reasons for its refusal, unless such reason is stated in the minutes of the Standing Committee's meeting.

RESEARCH GRANTS MADE FOR THE PERIOD ENDING DECEMBER, 1925.

Through the Auckland Institute:

Professor Sperrin-Johnson, £100 for research on mosquito control.

Mr. A. W. B. Powell, £50 for research on molluscan fauna of Manukau Harbour.

Research Committee, Auckland (R. D. Falla), £65 for ecological survey of the Inner Waitemata Harbour.

Professor F. P. Worley, £25 for continuation of research on essential oils of New Zealand Plants.

Mr. W. F. Short, £100 for research on the constitution of several constituents of New Zealand essential oils.

Through the Wellington Philosophical Society:

Dr. C. E. Adams, £200 for research on the Southern Stars with an interferometer.

Through the Philosophical Institute of Canterbury:

Professor H. G. Denham, £115 for low temperature carbonisation of New Zealand Coals.

Professor Charles Chilton, £100 for research on food supply of marine fishes.

Mr. A. Tonnoir, £50 for research on New Zealand Glowworms.

Through the Otago Institute:

Professor J. K. H. Inglis, £10 for continuation of research on essential oils of New Zealand Plants.

Professor J. Malcolm, £30 for continuation of research on New Zealand fishes.

Professor W. N. Benson, £50 for preparing rock sections of Dunedin region.

Through the Hawkes Bay Philosophical Institute:

Mr. H. Hill, £50 for artesian water survey of Taupo Plains.

Through the Nelson Institute:—

Professor T. H. Easterfield, £100 for continuation of research on cool storage of fruit.

BOARD OF SCIENCE AND ART.

FROM THE SCIENCE AND ART ACT, 1913, No. 22.

8. (1.) There shall be a Board styled "The Board of Science and Art," consisting of—

The Minister of Internal Affairs.

The Director of the Dominion Museum:

The President of the New Zealand Institute:—

Five persons to be appointed by the Governor-General in Council, each of whom shall hold office for three years from the date of his appointment.

(2.) The Board shall sit in the City of Wellington at such times and places as shall be appointed from time to time by the Minister.

(3.) Three of the members shall form a quorum.

(4.) At all meetings of the Board the Minister, if present, shall be the Chairman, and in his absence some member of the Board appointed by him in writing shall be Chairman.

(5.) The Chairman shall have a deliberate vote, and in all cases of equality of votes shall have a casting-vote.

(6.) *The President of the New Zealand Institute may appoint in writing a deputy, being a Governor of the New Zealand Institute, to attend and act at any meeting of the Board in his place; and such deputy, while so attending, shall be deemed to be a member of the Board.*

TONGARIRO NATIONAL PARK BOARD.

From the Tongariro National Park Act, 1922, No. 31.

5. (1.) The park shall be controlled and managed by a Board constituted as hereinafter provided.

(2.) The Board shall be a body corporate under the name of the Tongariro National Park Board, with perpetual succession and a common seal, and shall be capable of holding real and personal property and of doing and suffering all that bodies corporate may lawfully do or suffer.

(3.) The Board shall consist of the following persons:—

- (*a*) The Minister of Lands:
- (*b*.) The paramount chief for the time being of the Ngatituwharetoa Tribe of the Native race if that chief is a lineal descendant of Te Heuheu Tukino, the donor of the Native land included in the area of the Tongariro National Park:
- (*c*.) The Mayors of the cities of Auckland and Wellington.
- (*d*.) The Warden of the Park:
- (*e*.) The Under-Secretary of the Department of Lands and Survey:
- (*f*.) The General Manager of the Department of Tourist and Health Resorts:
- (*g*.) The Secretary of the State Forest Service:
- (*h*.) *The President of the New Zealand Institute*
- (*i*.) Not more than four persons to be appointed in that behalf by the Governor-General in Council.

* * * * *

8. (1.) The first ordinary meeting of the Board shall be held at such time and place as the Minister appoints, and subsequent ordinary meetings shall be held at such times and places as the Board appoints.

(2.) Special meetings of the Board may be called at any time by the Chairman, and he shall call one whenever any three members so request in writing.

THE HUTTON MEMORIAL MEDAL AND RESEARCH FUND.

Declaration of Trust.

This deed, made the fifteenth day of February, one thousand nine hundred and nine (1909), between the New Zealand Institute of the one part, and the Public Trustee of the other part: Whereas the New Zealand Institute is possessed of a fund consisting now of the sum of five hundred and fifty-five pounds one shilling (£555 1s.), held for the purposes of the Hutton Memorial Medal and Research Fund on the terms of the rules and regulations made by the Governors of the said Institute, a copy whereof is hereto annexed: And whereas the said money has been transferred to the Public Trustee for the purposes of investment, and the Public Trustee now holds the same for such purposes, and it is expedient to declare the trusts upon which the same is held by the Public Trustee:

Now this deed witnesseth that the Public Trustee shall hold the said moneys and all other moneys which shall be handed to him by the said Governors for the same purposes upon trust from time to time to invest the same upon such securities as are lawful for the the Public Trustee to invest on, and to hold the principal and income thereof for the purposes set out in the said rules hereto attached.

And it is hereby declared that it shall be lawful for the Public Trustee to pay all or any of the said moneys, both principal and interest, to the Treasurer of the said New Zealand Institute upon being directed so to do by a resolution of the Governors of the said Institute, and a letter signed by the Secretary of the said Institute enclosing a copy of such resolution certified by him and by the President as correct shall be sufficient evidence to the Public Trustee of the due passing of such resolution: And upon receipt of such letter and copy the receipt of the Treasurer for the time being of the said Institute shall be a sufficient discharge to the Public Trustee: And in no case shall the Public Trustee be concerned to inquire into the administration of the said moneys by the Governors of the said Institute.

As witness the seals of the said parties hereto, the day and year hereinbefore written.

Resolutions of Board of Governors.

Resolved by the Board of Governors of the New Zealand Institute that—

1. The funds placed in the hands of the Board by the committee of subscribers to the Hutton Memorial Fund be called " The Hutton Memorial Research Fund," in memory of the late Captain Frederick Wollaston Hutton, F.R.S. Such fund shall consist of the moneys subscribed and granted for the purpose of the Hutton Memorial, and all other funds which may be given or granted for the same purpose.

2. The funds shall be vested in the Institute. The Board of Governors of the Institute shall have the control of the said moneys, and may invest the same upon any securities proper for trust-moneys.

3. A sum not exceeding £100 shall be expended in procuring a bronze medal to be known as " The Hutton Memorial Medal."

4. The fund, or such part thereof as shall not be used as aforesaid, shall be invested in such securities as aforesaid as may be approved of by the Board of Governors, and the interest arising from such investment shall be used for the furtherance of the objects of the fund.

5. The Hutton Memorial Medal shall be awarded from time to time by the Board of Governors, in accordance with these regulations, to persons who have made some noticeable contribution in connection with the zoology, botany, or geology of New Zealand.

6. The Board shall make regulations setting out the manner in which the funds shall be administered. Such regulations shall conform to the terms of the trust.

7. The Board of Governors may, in the manner prescribed in the regulations, make grants from time to time from the accrued interest to persons or committees who require assistance in prosecuting researches in the zoology, botany, or geology of New Zealand.

8. There shall be published annually in the *Transactions of the New Zealand Institute* the regulations adopted by the Board as aforesaid, a list of the recipients of the Hutton Memorial Medal, a list of the persons to whom grants have been made during the previous year, and also, where possible, an abstract of researches made by them.

Resolution regarding Investment of Funds (see Clause 4 above) adopted by Board on 30th January, 1923, and published in New Zealand Gazette *of 28th May, 1925.*

That the fund known as the "Hutton Memorial Fund," consisting of the principal originally placed by the Board of Governors in the hands of the Public Trustee, together with the interest accrued thereon, be withdrawn from the Public Trustee and reinvested in such securities as provided for by legislation covering trust-moneys, power to arrange details and to act being given jointly to the Hon. Secretary and the Hon. Treasurer acting conjointly.

That until the Hutton Memorial Fund reaches the sum of £1,000 not less than 1 per cent. on the capital invested be added each year to the principal.

Regulations under which the Hutton Memorial Medal shall be awarded and the Research Fund administered.

1. Unless in exceptional circumstances, the Hutton Memorial Medal shall be awarded not oftener than once in every three years; and in no case shall any medal be awarded unless, in the opinion of the Board, some contribution really deserving of the honour has been made.

2. The medal shall not be awarded for any research published previous to the 31st December, 1906.

3. The research for which the medal is awarded must have a distinct bearing on New Zealand zoology, botany, or geology.

4. The medal shall be awarded only to those who have received the greater part of their education in New Zealand or who have resided in New Zealand for not less than ten years.

5. Whenever possible, the medal shall be presented in some public manner.

6. The Board of Governors may, at any annual meeting, make grants from the accrued interest of the fund to any person, society, or committee for the encouragement of research in New Zealand zoology, botany, or geology.

7. Applications for such grants shall be made to the Board before the 30th September.

8. In making such grants the Board of Governors shall give preference to such persons as are defined in regulation 4.

9. The recipients of such grants shall report to the Board before the 31st December in the year following, showing in a general way how the grant has been expended and what progress has been made with the research.

10. The results of researches aided by grants from the fund shall, where possible, be published in New Zealand.

11. The Board of Governors may from time to time amend or alter the regulations, such amendments or alterations being in all cases in conformity with resolutions 1 to 4.

Award of the Hutton Memorial Medal.

1911. Professor W. B. Benham, D.Sc., F.R.S., University of Otago—For researches in New Zealand zoology.

1914. Dr. L. Cockayne, F.L.S., F.R.S.—For researches in the ecology of New Zealand plants.

1917. Professor P. Marshall, M.A., D.Sc.—For researches in New Zealand geology.

1920. Rev. John E. Holloway, D.Sc.—For researches in New Zealand pteridophytic botany.

1923. J. Allan Thomson, M.A., D.Sc., F.G.S., F.N.Z.Inst.—For researches in geology.

Grant from the Hutton Memorial Research Fund.

1919. Miss M. K. Mestayer £10, for work on the New Zealand Mollusca.

1923. Professor P. Marshall, M.A., D.Sc., F.N.Z.Inst.—£40, for study of Upper Cretaceous ammonites of New Zealand.

HECTOR MEMORIAL RESEARCH FUND.

Declaration of Trust.

This deed, made the thirty-first day of July, one thousand nine hundred and fourteen, between the New Zealand Institute, a body corporate duly incorporated by the New Zealand Institute Act, 1908, of the one part, and the Public Trustee of the other part; Whereas

by a declaration of trust dated the twenty-seventh day of January, one thousand nine hundred and twelve, after reciting that the New Zealand Institute was possessed of a fund consisting of the sum of £1,045 10s. 2d., held for the purposes of the Hector Memorial Research Fund on the terms of the rules and regulations therein mentioned, which said moneys had been handed to the Public Trustee for investment, it was declared (*inter alia*) that the Public Trustee should hold the said moneys and all other moneys which should be handed to him by the said Governors of the Institute for the same purpose upon trust from time to time, to invest the same in the common fund of the Public Trust Office, and to hold the principal and income thereof for the purposes set out in the said rules and regulations in the said deed set forth: And whereas the said rules and regulations have been amended by the Governors of the New Zealand Institute, and as amended are hereinafter set forth: And whereas it is expedient to declare that the said moneys are held by the Public Trustee upon the trusts declared by the said deed of trust and for the purposes set forth in the said rules and regulations as amended as aforesaid.

Now this deed witnesseth and it is hereby declared that the Public Trustee shall hold the said moneys and all other moneys which shall be handed to him by the said Governors for the same purpose upon trust from time to time to invest the same in the common fund of the Public Trust Office, and to hold the principal and income thereof for the purposes set out in the said rules and regulations hereinafter set forth:

And it is hereby declared that it shall be lawful for the Public Trustee to pay, and he shall pay, all or any of the said moneys, both principal and interest, to the Treasurer of the said New Zealand Institute upon being directed to do so by a resolution of the Governors of the said Institute, and a letter signed by the Secretary of the said Institute enclosing a copy of such resolution certified by him and by the President as correct shall be sufficient evidence to the Public Trustee of the due passing of such resolution: And upon receipt of such letter and copy the receipt of the Treasurer for the time being of the said Institute shall be a sufficient discharge to the Public Trustee: And in no case shall the Public Trustee be concerned to inquire into the administration of the said moneys by the Governors of the said Institute.

As witness the seals of the said parties hereto, the day and year first hereinbefore written.

Rules and Regulations made by the Governors of the New Zealand Institute in relation to the Hector Memorial Research Fund.

1. The funds placed in the hands of the Board by the Wellington Hector Memorial Committee shall be called "The Hector Memorial Research Fund," in memory of the late Sir James Hector, K.C.M.G., F.R.S. The object of such fund shall be the encouragement of scientific research in New Zealand, and such fund shall consist of the moneys subscribed and granted for the purpose of the memorial and all other funds which may be given or granted for the same purpose.

2. The funds shall be vested in the Institute. The Board of Governors of the said Institute shall have the control of the said moneys, and may invest the same upon any securities proper for trust-moneys.

3. A sum not exceeding one hundred pounds (£100) shall be expended in procuring a bronze medal, to be known as the Hector Memorial Medal.

4. The fund, or such part thereof as shall not be used as aforesaid, shall be invested in such securities as may be approved by the Board of Governors, and the interest arising from such investment shall be used for the furtherance of the objects of the fund by providing thereout a prize for the encouragement of such scientific research in New Zealand of such amount as the Board of Governors shall from time to time determine.

5. The Hector Memorial Medal and prize shall be awarded annually by the Board of Governors.

6. The prize and medal shall be awarded by rotation for the following subjects, namely—(1) Botany, (2) chemistry, (3) ethnology, (4) geology, (5) physics (including mathematics and astronomy), (6) zoology (including animal physiology).

In each year the medal and prize shall be awarded to that investigator who, working within the Dominion of New Zealand, shall in the opinion of the Board of Governors have done most towards the advancement of that branch of science to which the medal and prize are in such year allotted.

7. Whenever possible the medal shall be presented in some public manner.

Resolution regarding Investment of Funds (see Clause 4 above) adopted by Board on 30th January, 1923, and published in New Zealand Gazette *of 28th May, 1925.*

That the fund known as the "Hector Memorial Fund," consisting of the principal originally placed by the Board of Governors in the hands of the Public Trustee, together with the interest accrued thereon, be withdrawn from the Public Trustee and reinvested in such securities as provided for by legislation covering trust-moneys, power to arrange details and to act being given jointly to the Hon. Secretary and the Hon. Treasurer acting conjointly.

Award of the Hector Memorial Research Fund.

1912. L. Cockayne, Ph.D., F.L.S., F.R.S.—For researches in New Zealand botany.
1913. T. H. Easterfield, M.A., Ph.D.—For researches in chemistry.
1914. Elsdon Best—For researches in New Zealand ethnology.
1915. P. Marshall, M.A., D.Sc., F.G.S.—For researches in New Zealand geology.
1916. Sir Ernest Rutherford, F.R.S.—For researches in physics.
1917. Charles Chilton, M.A., D.Sc., F.L.S., C.M.Z.S.—for researches in zoology.
1918. T. F. Cheeseman, F.L.S., F.Z.S.—For researches in New Zealand systematic botany.

1919. P. W. Robertson—For researches in chemistry.
1920. S. Percy Smith—For researches in New Zealand ethnology.
1921. R. Speight, M.A., M.Sc., F.G.S.—For work in New Zealand geology.
1922. C. Coleridge Farr, D.Sc.—For research in physical science, and more particularly work in connection with the magnetic survey of New Zealand.
1923. G. V. Hudson, F.E.S., F.N.Z.Inst.—For researches in New Zealand entomology.
1924. D. Petrie, M.A., F.N.Z.Inst.—For researches in New Zealand botany.
1925. B. C. Aston, F.I.C., F.N.Z.Inst.—For the investigation of New Zealand chemical problems.
1926. H. D. Skinner, B.A.—For research in Ethnology.

HAMILTON MEMORIAL FUND.

1. The fund placed in the hands of the Board by the Wellington Philosophical Society shall be called the "Hamilton Memorial Fund" in memory of the late Augustus Hamilton, Esq. Such fund shall consist of the moneys subscribed and granted for the purpose of the memorial and all other funds which may be given or granted for the same purpose.

2. The fund shall be vested in the Institute. The Board of Governors of the Institute shall have the control thereof, and shall invest the same in any securities proper for trust-moneys.

3. The memorial shall be a prize, to be called the "Hamilton Memorial Prize," the object of which shall be the encouragement of beginners in pure scientific research in New Zealand.

4. The prize shall be awarded at intervals of not less than three years by the Governors assembled in annual meeting, but in no case shall an award be made unless in the opinion of the Governors some contribution deserving the honour has been made. The first award shall be made at the annual meeting of the Governors in 1923.

5. The prize shall be awarded for original pure scientific research-work, carried out in New Zealand or in the Islands of the South Pacific Ocean, which has been published within the five years preceding the first day of July prior to the annual meeting at which the award is made. Such publication may consist of one or more papers, and shall include the first investigation published by the author. No candidate shall be eligible for the prize who prior to such period of five years has published the result of any scientific investigation.

6. The prize shall consist of money. Until the principal of the fund amounts to £100, one-half of the interest shall be added annually to the principal and the other half shall be applied in payment of the prize. So soon as the said principal amounts to £100 the whole of the interest thereon shall be applied in payment of the prize, in each case after the payment of all expenses necessarily incurred by the Governors in the investment and administration of the said fund and award of the said prize.

7. A candidate for the prize shall send to the Hon. Secretary of the New Zealand Institute, on or before the 30th day of June preceding the date of the annual meeting at which the award is to be made, an intimation of his candidature, together with at least two copies of each publication on which his application is based.

8. Whenever possible the prize shall be presented in some public manner.

THE CARTER BEQUEST.

Extracts from the Will of Charles Rooking Carter.

This is the last will and testament of me, Charles Rooking Carter, of Wellington, in the Colony of New Zealand, gentleman.

I revoke all wills and testamentary dispositions heretofore made by me, and declare this to be my last will and testament.

* * * * *

I give to the Colonial Museum in Wellington the large framed photographs of the members of the General Assembly in the House of Representatives in the year 1860, and the framed pencil sketch of the old House of Commons, and the framed invitation-card to the Lord Mayor's dinner.

* * * * *

As regards the following books, of which I am the author, and which are now stored in three boxes—namely, (1) "The Life and Recollections of a New Zealand Colonist," (2) "A Historical Sketch of New Zealand Loans," and (3) "Round the World Leisurely"—I direct that my executor shall retain possession of the same for a period of seven years, commencing from the date of my death, and that at the end of such period my executor shall place the same in the hands of Messrs. Whitcombe and Tombs (Limited) or some other capable and responsible booksellers in the City of Wellington, for sale, and so that the same shall be sold at such a price as will yield to my estate not less than six shillings per volume in respect of the first-named and second-named, and two shillings and sixpence in respect of the last-named works; and I further authorize my executor to sell and dispose of the copyright or right to reprint such works; and I direct that the moneys to be derived from the sale of such works and the privileges connected therewith shall be added to the sum provided for the purchase of a telescope as hereinafter mentioned.

I direct my executor to subscribe the sum of fifty pounds towards the erection of a suitable brick room in which to house the priceless collection of books on New Zealand some time since given by me to the Colonial Museum and the New Zealand Institute.

I give and devise unto the Public Trustee appointed under and in pursuance of an Act of the General Assembly of New Zealand intituled the Public Trust Office Act, 1894 (hereinafter called "my

trustee "), all the rest, residue, and remainder of my property whatsoever and wheresoever situate, both real and personal, and whether in possession, reversion, expectancy, or remainder, upon trust, as to my freehold property at East Taratahi, containing by admeasurement two thousand one hundred and seventy-two acres, and being and comprising the whole of the land included in certificate of title, volume 51, folio 79, of the books of the District Land Registrar for the Registration District of Wellington, (save and except such part of the said land, being portion of the section numbered 117 in the Taratahi Plain Block, as is hereinafter devised to my trustee for the purposes hereinafter appearing), and direct that my trustee shall stand possessed of the same lands upon trust, to let and manage the same, and to pay and apply the rents and annual income in manner following, namely:—

* * * * *

And as to all the residue and remainder (if any) of the said net proceeds of the sale, conversion, and getting-in of my estate as aforesaid, my trustee shall transfer the same to the Governors for the time being of the New Zealand Institute at Wellington, to form the nucleus of a fund for the erection in or near Wellington aforesaid, and the endowment of a Professor and staff, of an Astronomic Observatory fitted with telescope and other suitable instruments for the public use and benefit of the colony, and in the hope that such fund may be augmented by gifts from private donors, and that the Observatory may be subsidized by the Colonial Government; and without imposing any duty or obligation in regard thereto I would indicate my wish that the telescope may be obtained from the factory of Sir H. Grubb, in Dublin, Ireland.

* * * * *

Resolution regarding Investment of Funds (see Clause 4 above), adopted by Board on 30th January, 1923, and published in the New Zealand Gazette, *of 28th May, 1925.*

That the fund known as the "Carter Bequest," consisting of the principal originally placed by the Board of Governors in the hands of the Public Trustee, together with the interest accrued thereon, be withdrawn from the Public Trustee and reinvested in such securities as provided for by legislation covering trust-moneys, power to arrange details and to act being given jointly to the Hon. Secretary and the Hon. Treasurer acting conjointly.

NEW ZEALAND INSTITUTE, 1926.

ESTABLISHED UNDER AN ACT OF THE GENERAL ASSEMBLY OF NEW ZEALAND INTITULED THE NEW ZEALAND INSTITUTE ACT, 1867; RECONSTITUTED BY AN ACT OF THE GENERAL ASSEMBLY OF NEW ZEALAND UNDER THE NEW ZEALAND INSTITUTE ACT, 1903, AND CONTINUED BY THE NEW ZEALAND INSTITUTE ACT, 1908.

BOARD OF GOVERNORS.

EX OFFICIO.

His Excellency the Governor-General.
The Hon. the Minister of Internal Affairs.

NOMINATED BY THE GOVERNMENT.

Dr. Charles Chilton, F.L.S., C.M.Z.S., F.N.Z. Inst. (reappointed December, 1924); Dr. Leonard Cockayne, F.R.S., F.L.S., F.N.Z.-Inst. (reappointed December, 1924); Mr B. C. Aston, F.I.C., F.C.S., F.N.Z.Inst. (reappointed December, 1925); Dr. J. Allan Thomson, F.G.S., F.N.Z.Inst. (reappointed December, 1925).

ELECTED BY AFFILIATED SOCIETIES, 1925.

Wellington Philosophical Society	Mr. G. V. Hudson, F.E.S., F.N.Z.Inst. Professor H. B. Kirk, M.A., F.N.Z.Inst.
Auckland Institute	Professor H. W. Segar, M.A., Ph.D., F.N.Z.Inst. Professor F. P. Worley, D.Sc.
Philosophical Institute of Canterbury	Professor C. Coleridge Farr, D.Sc., F.P.S.L., F.N.Z.Inst. Mr. A. M. Wright, A.I.C., F.C.S.
Otago Institute	Hon. G. M. Thomson, F.L.S., F.N.Z.Inst., M.L.C. Professor J. Park, F.G.S., F.N.Z.Inst.
Hawke's Bay Philosophical Institute	Mr. H. Hill, B.A., F.G.S.
Nelson Institute	Professor T. H. Easterfield, M.A., Ph.D., F.I.C., F.N.Z.-Inst.
Manawatu Philosophical Society	Mr. M. A. Eliott.

OFFICERS FOR THE YEAR 1926.

PRESIDENT: Mr. B. C. Aston, F.I.C., F.C.S., F.N.Z.Inst.

HON. TREASURER: Mr. M. A. Eliott.

HON. EDITOR: Mr. Johannes C. Andersen, F.N.Z.Inst.

HON. LIBRARIAN: Professor D. M. Y. Somerville, M.A., D.Sc., F.R.S.E., F.N.Z.Inst.

HON. RETURNING OFFICER: Professor H. W. Segar, M.A., Ph.D., F.N.Z.Inst.

HON. SECRETARY: P. Marshall, D.Sc., M.A., F.G.S., F.N.Z.Inst.

AFFILIATED SOCIETIES, 1925-26.

Name of Society.	Secretary's Name and Address.	Date of Affiliation.
Wellington Philosophical Society	Mr. W. J. Phillipps, Dominion Museum, Wellington	10th June, 1868.
Auckland Institute	Mr. G. Archey, Auckland Institute and Museum, Auckland	10th June, 1868.
Philosophical Institute of Canterbury	Mr. G. Jobberns, Training College, Christchurch.	22nd October, 1868.
Otago Institute	Rev. Dr. J. Holloway, Otago University, Dunedin.	18th October, 1869.
Hawkes Bay Philosophical Institute	Mr. C. F. H. Pollock, P. O. Box 301, Napier.	31st March, 1875.
Nelson Institute	Mrs. Margaret Graham, Nelson	20th December, 1883
Manawatu Philosophical Society	Mr. J. S. Hornblow, Young's Buildings, Broadway, Palmerston North	6th January, 1905.

FORMER MANAGER AND EDITOR.

[UNDER THE NEW ZEALAND INSTITUTE ACT, 1867.]

1867-1903.—Hector, Sir James, M.D., K.C.M.G., F.R.S.

PAST PRESIDENTS.

1903-4.—Hutton, Captain Frederick Wollaston, F.R.S.
1905-6.—Hector, Sir James, M.D., K.C.M.G., F.R.S.
1907-8.—Thomson, George Malcolm, F.L.S.
1909-10.—Hamilton, A.
1911-12.—Cheeseman, T. F., F.L.S., F.Z.S.
1913-14.—Chilton, C., M.A., D.Sc., LL.D., F.L.S., C.M.Z.S.
1915.—Petrie, D., M.A., Ph.D.
1916-17.—Benham, W. B., M.A., D.Sc., F.Z.S., F.R.S.
1918-19.—Cockayne, L., Ph.D., F.R.S., F.L.S., F.N.Z.Inst.
1920-21.—Easterfield, T. H., M.A., Ph.D., F.N.Z.Inst.
1922-23.—Kirk, H. B., M.A., F.N.Z.Inst.
1924-25.—Dr. P. Marshall, M.A., F.G.S., F.N.Z.Inst.

HONORARY MEMBERS.

	Elected
Bateson, Professor W., F.R.S., Merton, Surrey, England	1915
Bragg, Professor W. H., F.R.S., University of London	1923
Chree, Charles, M.A., D.Sc., LLD., F.R.S., Kew Observatory, London	1924
David, Professor T. Edgeworth, F.RS,, C.M.G., Sydney University	1904
Davis, Professor W. Morris, Harvard University, Cambridge, Mass., U.S.A.	1913
Diels, Professor L., Ph.D., University of Marburg	1907
Einstein, Professor Albert, University of Berlin, Germany	1924
Fraser, Sir J. G., D.C.L., No. 1 Brick Court, Temple, London, E.C. 4	1920
Goebel, Professor Dr. Carl von, University of Munich	1901
Goodale, Professor G. L., M.D., LL.D., Harvard University, Cambridge, Mass., U.S.A.	1891
Gregory, Professor J. W., D.Sc., F.R.S., F.G.S., University, Glasgow	1920
Haddon, Dr. A. C., F.R.S., 3 Cranmer Road, Cambridge	1925
Hall, Sir A. D., M.A., K.C.B., F.R.S., Ministry of Agriculture, London	1920
Hedley, Charles, F.L.S., Australian Museum, Sydney	1924
Klotz, Professor Otto J., 437 Albert Street, Ottawa, Canada	1903
Liversidge, Professor A., M.A., F.R.S., Fieldhead, Coombe Warren, Kingston Hill, England	1890
Lotsy, Dr. J. P., Haarlem, Holland	
Massart, Professor Jean, University of Brussels, Belgium	1916
Mawson, Sir Douglas, B.E., D.Sc., The University, Box 498, Adelaide	1920
Mellor, Joseph William, D.Sc. (N.Z.), Sandon House, Regent Street, Stoke-on-Trent, England	1919
Meyrick, E., B.A., F.R.S., Marlborough College, England	1907
Nordstedt, Professor Otto, Ph.D., University of Lund, Sweden	1890
Rutherford, Professor Sir E., D.Sc., F.R.S., F.N.Z.Inst., Nobel Laureate, Cambridge, England	1904
Sars, Professor G. O., University of Christiania, Norway	1902
Stebbing, Rev. T. R. R., F.R.S., Tunbridge Wells, England	1907
Thiselton-Dyer, Sir W. T., K.C.M.G., C.I.E., LL.D., M.A., F.R.S., Witcombe, Gloucester, England	1894
Woods, Henry, MA., F.R.S., F.G.S., University, Cambridge	1920

FORMER HONORARY MEMBERS.

	Elected
Agardh, Dr. J. G.	1900
Agassiz, Professor Louis	1870
Arber, E. A. Newell, M.A., Sc.D., F.G.S., F.L.S.	1914
Avebury, Lord, P.C., F.R.S.	1900
Baird, Professor Spencer F.	1877
Balfour, Professor I. Bayley, F.R.S.	1914
Beddard, F. E., D.Sc., F.R.S., Zoological Society, London	1906
Beneden, Professor J. P. van	1888
Berggren, Dr. S.	1876
Bowen, Sir George Ferguson, G.C.M.G.	1873
Brady, G. S., D.Sc., F.R.S.	1906
Bruce, Dr. W. S.	1910
Carpenter, Dr. W. B., C.B., F.R.S.	1883
Clarke, Rev. W. B., M.A., F.R.S.	1876
Codrington, Rev. R. H., D.D.	1894
Darwin, Charles, M.A., F.R.S.	1871
Darwin, Sir George, F.R.S.	1909
Davis, J. W., F.G.S., F.L.S.	1891
Dendy, Dr. A., F.R.S., King's College, University of London, England	1907
Drury, Captain Byron, R.N.	1870
Ellery, Robert L. J., F.R.S.	1883
Etheridge, Professor R., F.R.S.	1876
Ettingshausen, Baron von	1888
Eve, H. W., M.A.	1901
Filhol, Dr. H.	1875
Finsch, Professor Otto, Ph.D.	1870
Flower, Professor W. H., F.R.S.	1870
Garrod, Professor A. H., F.R.S.	1878
Gray, J. E., Ph.D., F.R.S.	1871
Gray, Professor Asa	1885
Grey, Sir George, K.C.B.	1872
Günther, A., M.D., M.A., Ph.D., F.R.S.	1878
Haswell, Professor W. A., F.R.S., Mimihau, Woollahra Point, Sydney	1914
Hemsley, Dr. W. Botting, F.R.S., Kew Lodge, St. Peter's Road, Broadstairs, Kent, England	1913
Hochstetter, Dr. Ferdinand von	1870
Hooker, Sir J. D., G.C.S.I., C.B., M.D., F.R.S., O.M.	1870
Howes, G. B., LL.D., F.R.S.	1901
Huxley, Thomas H., LL.D., F.R.S.	1872
Langley, S. P.	1896
Lindsay, W. Lauder, M.D., F.R.S.E.	1871
Lydekker, Richard, F.R.S.	1896
Lyell, Sir Charles, Bart., D.C.L., F.R.S.	1873
McCoy, Professor Sir F., K.C.M.G., D.Sc., F.R.S.	1888
McLachlan, Robert, F.L.S.	1874
Massee, George, F.L.S., F.R.M.S.	1900
Milne, J., F.R.S.	1906
Mitten, William, F.R.S.	1895
The Most Noble the Marquis of Normanby, G.C.M.G.	1880
Mueller, Ferdinand von, M.D., F.R.S., C.M.G.	1870
Müller, Professor Max, F.R.S.	1878
Newton, Alfred, F.R.S.	1874
Owen, Professor Richard, F.R.S.	1870
Pickard - Cambridge, Rev. O., M.A., F.R.S., C.M.Z.S.	1873
Richards, Rear-Admiral G. H.	1870
Riley, Professor C. V.	1890
Rolleston, Professor G., M.D., F.R.S.	1875
Sclater, P. L., M.A., Ph.D., F.R.S.	1875
Sharp, Dr. D.	1877
Sharp, Richard Bowdler, M.A., F.R.S.	1885
Stokes, Vice-Admiral J. L.	1872
Tenison-Woods, Rev. J. E., F.L.S.	1878
Thomson, Professor Wyville, F.R.S.	1874
Thomson, Sir William, F.R.S.	1883
Wallace, Sir A. R., F.R.S., O.M.	1885
Weld, Frederick A., C.M.G.	1877

FELLOWS OF THE NEW ZEALAND INSTITUTE.

ORIGINAL FELLOWS.

(See *New Zealand Gazette*, 20th November, 1919.)

†Aston, Bernard Cracroft, F.I.C., F.C.S.
*‡Benham, Professor William Blaxland, M.A., D.Sc., F.R.S., F.Z.S.
†Best, Elsdon.
*†Cheeseman, Thomas Frederick, F.L.S., F.Z.S. §
*†Chilton, Professor Charles, M.A., D.Sc., LL.D., M.B., C.M., F.L.S., C.M.Z.S.
*†‡Cockayne, Leonard, Ph.D., F.R.S., F.L.S.
†Easterfield, Professor Thomas Hill, M.A., Ph.D., F.I.C., F.C.S.
Farr, Professor Clinton Coleridge, D.Sc., F.P.S.L., Assoc.M.Inst.C.E.
Hogben, George, C.M.G., M.A., F.G.S. §
Hudson, George Vernon, F.E.S.
Kirk, Professor Harry Borrer, M.A.
†‡Marshall, Patrick, M.A., D.Sc., F.G.S., F.R.G.S., F.E.S.
*Petrie, Donald, M.A., Ph.D. §
†Rutherford, Sir Ernest, Kt., F.R.S., D.Sc., Ph.D., LL.D.
Segar, Professor Hugh William, M.A.
Smith, Stephenson Percy, F.R.G.S.§
Speight, Robert, M.A., M.Sc., F.G.S.
Thomas, Professor Algernon Phillips Withiel, M.A., F.L.S.
*Thomson, Hon. George Malcolm, F.L.S., M.L.C.
Thomson, James Allan, M.A., D.Sc., A.O.S.M., F.G.S.

FELLOWS ELECTED, 1921.

Cotton, Charles Andrew, D.Sc., A.O.S.M., F.G.S.
Hilgendorf, Frederick William, B.A., D.Sc.
Holloway, Rev. John Ernest, L.Th., D.Sc.
Park, Professor James, M.Am.Inst.M.E., M.Inst.M.M., F.G.S.

FELLOWS ELECTED, 1922.

Laing, Robert Malcolm, M.A., B.Sc.
Marsden, Ernest, D.Sc., F.R.A.S.
Morgan, Percy Gates, M.A., F.G.S., A.O.S.M.
Sommerville, Duncan McLaren Young, M.A., D.Sc., F.R.S.E.

FELLOWS ELECTED, 1923.

Williams, Ven. Archdeacon Herbert William, M.A.
Andersen, Johannes Carl.

FELLOWS ELECTED, 1924.

Smith, William Herbert Guthrie.
Tillyard, Robin John, M.A., D.Sc., Sc.D., F.L.S., F.E.S.

FELLOWS ELECTED, 1925.

Brown, Professor J. Macmillan, M.A., LL.D.
Te Rangi Hiroa (P H. Buck), M.D., Ch.B. (N.Z.).

FELLOWS ELECTED, 1926.

Benson, Professor W. N., B.A., D.Sc., F.G.S.
Maclaurin, J. S., D.Sc., F.C.S.

* Past President. † Hector Medallist. ‡ Hutton Medallist. § Deceased.

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Date of issue.	Date of issue.	Date of issue.
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